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A Glance at the Contents—

Safety Device for Calorimeters.

From Mr. A. L. Norton, of the Redditch Gas Company, we have received an account of a gas cut-off safety device for water flow calorimeters. [p. 31.]

High-Pressure Distribution.

Some details of the high-pressure distribution system at Halifax were given before the Yorkshire Junior Gas Association by Mr. H. Firth and Mr. H. Ramsden. [p. 40.]

Lighting Superintendent Required.

Applications are invited for the appointment of Lighting Superintendent to the County Borough of Bolton at a salary of £300 per annum with house, coal, light, and water free. [p. 48.]

Reducing District Complaints.

In a paper before the Western Junior Gas Association Mr. A. R. Langford, of the Plymouth and Stonehouse Gas Light and Coke Company, dealt with methods for reducing district complaints. [p. 36.]

Plant Safeguards.

The protection of works units against breakdown and plant operations against personal injury forms the subject of an interesting article by Mr. H. C. Widlake, of the Plymouth and Stonehouse Gas Light and Coke Company. [p. 33.]

Gas Heating for Churches.

An article on this subject gives useful information of the variations in the demand for heat in different churches, and shows that competitors of gas heating have exaggerated ideas of the amount of gas required for the purpose. [p. 31.]

Crude Benzole from Vertical Retort Gas.

Mr. H. J. Reynolds, of Wolverhampton, discussed the subject of crude benzole recovery from vertical retort gas before a meeting of the Midland Junior Gas Association. [p. 38.]

High-Pressure Gas for Road Transport.

In a paper before the Yorkshire Junior Gas Association, Mr. F. B. Halliwell described some of the experiences of the Rotherham Gas Department with high-pressure gas for road transport purposes. [p. 39.]

A Pioneer Among Small Undertakings.

A new continuous flow automatic water gas plant at the works of the Raunds Gas Light and Coke Company, Ltd., is described. This is the first installation of its kind to be erected in this country. [p. 29.]

Southern Association.

On Tuesday of last week the Annual General Meeting of the Southern Association of Gas Engineers and Managers was held at the Hotel Metropole, Northumberland Avenue, W.C. 2, under the Presidency of Mr. Stephen Lacey (Controller of Gas Sales of the Gas Light and Coke Company). [p. 35.]

Liability in Fatal Gas Explosions.

A test case of considerable importance was decided in the High Court by Mr. Justice du Parcq, when a widow, of Calville Street, Gateshead, sued the Gateshead Corporation, one of their contractors, and the Newcastle and Gateshead Gas Company for damages for the death of her husband, and expenses to herself and her infant son caused by a gas explosion which wrecked her home. [p. 30.]

Forthcoming Engagements

April 6.—NORTH BRITISH ASSOCIATION.—Spring Meeting at Perth.

April 6.—LONDON AND SOUTHERN JUNIOR ASSOCIATION.—Meeting. Paper by Mr. H. H. Brown.

April 7.—MANCHESTER AND DISTRICT JUNIOR ASSOCIATION.—Annual Dinner. Paper by Mr. H. Platt.

April 7.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Visit to Messrs. J. G. Stein & Co., Castle Carey. Paper by Mr. R. Malcolm.

April 9.—I.G.E.—Meetings of Finance Sub-Committee, 1.45 p.m.; Membership Sub-Committee, 2.30 p.m.; General Purposes Committee, 3.15 p.m.; Benevolent Fund Committee of Management, 4.30 p.m.

April 9.—GAS COMPANIES' PROTECTION ASSOCIATION.—Meeting of Committee, 5, Victoria Street, S.W. 1, 2.30 p.m.

April 10.—I.G.E.—Meetings of Council, 10 a.m.; Education Committee, 4 p.m.

April 10.—N.G.C.—Meeting of Central Executive Board, 28, Grosvenor Gardens, S.W. 1, 2.30 p.m.

April 10.—FEDERATION OF GAS EMPLOYERS.—Meeting of Central Committee, 28, Grosvenor Gardens, S.W. 1.

April 11.—I.G.E.—Meetings of Education Executive Committee, 10 a.m.; Sir Arthur Duckham Memorial Fund Executive Committee, 2.30 p.m.

April 14.—WESTERN JUNIOR GAS ASSOCIATION.—Annual General Meeting at Bath.

April 18.—B.C.G.A.—Meetings of Executive Committee 11.30 a.m.; General Committee 2.30 p.m., at 28, Grosvenor Gardens, S.W. 1.

April 19.—S.B.G.I.—Council Meeting at 2.30 p.m.

April 19.—SOUTHERN ASSOCIATION (WESTERN DISTRICT).—Commercial Meeting at Devonport.

April 20.—B.C.G.A.—Annual Meeting of Salesmen's Circles, Caxton Hall.

April 30.—I.G.E.—Meeting of Liquor Effluents and Ammonia Sub-Committee, 2.30 p.m.

May 1.—I.G.E.—Meetings of Joint Research Committee, 10.30 a.m.; General Research Committee, 2.30 p.m.

May 9.—S.B.G.I.—Annual General Meeting and Dinner, Hotel Metropole, London.

May 10 & 11.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Spring Meeting at Cleethorpes.

May 12.—SCOTTISH EASTERN JUNIOR ASSOCIATION.—Annual General Meeting and Paperette Day in Heriot Watt College, Edinburgh.

May 17.—WALES AND MONMOUTHSHIRE ASSOCIATION.—General Meeting at Cardiff.

June 5-8.—I.G.E.—Annual General Meeting, London.

EDITORIAL NOTES

Automatic Water Gas Production

On later pages is a description of a completely automatic, trouble-free water gas plant—the first of its kind to be put into operation in this country—installed at the works of a small gas undertaking, the Raunds Gas Light and Coke Company, Ltd. The carbonizing plant at the Raunds Works consists of stop-end horizontal retorts in three beds of fives, and the labour is simply one stoker per shift, the annual output of the undertaking being 30 million c.ft. When, last year, extension of the gas-making plant to cope with increasing demand came up for consideration, the advantages of being able to dilute the coal gas with water gas naturally held much appeal; and when it was found that all the advantages of flexibility of operation and control of the coke market could be gained without adding to labour charges, small wonder that Mr. W. Bolton, Engineer, Manager, and Secretary of the Company, decided to install an automatic plant.

Through the courtesy of Mr. Bolton we were able to inspect the new plant, and it certainly has many attractive features. The patentee is Mr. James Lowe, of Auckland, N.Z., and the plant was erected by Messrs. Davison & Partner, Ltd., who have secured the British manufacturing rights. The nominal capacity of the Raunds installation is 60,000 c.ft. a day, and the plant has been evolved specially to meet the demand of the smaller gas-works. For dilution of coal gas to be satisfactory, the diluent should, of course, be added uniformly to maintain constant composition and calorific value of the gas supplied to the district. With the Lowe plant operating continuously this can be assured even where there is no relief holder, for water gas is made continuously. There are two generators, and when one is on the " blow," the other is gas-making. Change-over from blast to " run " is automatically effected by hydraulically operated cylinders. Though at Raunds hydraulic power is supplied by a pump, actually the cylinders have been so designed that with a town's main supply of water at moderate pressure the pump could be dispensed with or retained as a stand-by. The continuous make of water gas can be passed to the coal gas installation—an important point. Actually plants installed in New Zealand are operating satisfactorily on this principle.

Finally, a word as to the flexibility of this small water gas plant. Since being installed it has been operated on various cycles, the output forced, worked on normal production and at various reduced outputs down to as low as 25% of the guaranteed production figure, and no difficulty has been experienced in producing a regular supply of water gas of uniform quality. All this without additional labour cost.

Credit for Industry, Ltd.

The difficulty experienced by smaller businesses in raising capital, even when the security offered is good, has long been recognized; but it is hoped that Credit for Industry, Ltd., will ease the path of the individual, who nowadays too often finds himself at a disadvantage as compared with the big joint-stock businesses. The United Dominions Trust, of which Mr. J. Gibson Jarvie is Chairman, are registering a company with this title, and it is to have an initial capital of £250,000. The United Dominions Trust have already done much in the direction of financing industry, largely in connection with instalment buying, and there should be no difficulty whatever in securing the requisite support for this new venture.

Publishing details of the scheme, the *Financial Times* remarks that " it should be a great relief to the head of the small and medium-sized business, as the services of the new organization become known, to realize that he can turn definitely in a certain direction for the form of aid which it has been most difficult to find. The plan that anything up to £50,000 shall be available, from two to twenty or more years, shows both that the ' big fellow ' will not be allowed to butt in and that there will be no encroachment on existing organizations. The commencing capital of £250,000 is modest, but it will be increased and debentures issued as the facilities are used. This mobilization of finance for the smaller undertakings should do a great deal to stimulate industry and in due course make available acceptable investments for the public."

The need for such arrangements as are here contemplated was indicated by the Macmillan Committee on Finance and Industry, in their statement that " to provide adequate machinery for raising long-dated capital in amounts not sufficiently large for a public issue—that is, amounts ranging from small sums up to (say) £200,000 or more—always presents difficulties. The expense of a public issue is too great, in proportion to the capital raised, and therefore it is difficult to interest the ordinary investor by the usual method; the investment trust companies do not look with any great favour on small issues which would have no free market and would require closely watching; nor can any issuing house tie up its funds in long-dated capital issues of which it cannot dispose. In general, therefore, these smaller capital issues are made through brokers or through some private channel among investors in the locality where the business is situated. This may often be the most satisfactory method. As we do not think they could be handled as a general rule by a larger concern of the character that we have outlined, the only other alternative would be to form a company to devote itself particularly to these smaller industrial and commercial issues."

Safety First

In the " Journal " for Jan. 3, 1934, was discussed the manner in which warning devices can be employed for giving timely notice of irregularities in the functioning of gas supply systems. The author of that contribution, Mr. H. C. Widlake, in a complementary article begun in our columns to-day, considers works safeguards and offers much useful advice on the prevention of accident involving life or limb or breakdown of plant. As the author points out, on a modern gas manufacturing plant the various units are so interdependent that the ultimate effect of quite a minor breakdown is far reaching and out of all proportion to the primary cause. It is this condition of interdependence that makes the " gadget " of yesterday the essential of to-day. It is a fact that most serious breakdowns are caused by poor maintenance and failure to detect and rectify minor defects before they have a chance to develop; and in this connection our contributor maintains that it is bad practice to trust to plant operators and engine drivers to report defects, since a noise grows by such minute increments that men working all their time in the neighbourhood of the machine concerned often fail to notice anything amiss. This, of course, is particularly true of machines which are characteristically noisy in operation.

A section of the article is concerned with circuit breakers, which rank among the most valuable protective devices against mechanical as well as electrical breakdowns. In the case of a retort working machine the protection provided by a well-selected breaker

covers every mechanical detail, from the pusher head back to the shaft of the motor. Whatever the nature of the machine to be driven there is a telling argument for the use of circuit breakers on all but the smallest drives, and particularly where the motor is rigidly tied to its load. Any sudden " hang-up " in the driving mechanism, as in an elevator, a crusher, or a conveyor, results in the falling of the breaker and the consequent limitation of the damage caused.

Turning to safety measures to prevent accidents to operations, Mr. Widlake deals with several types of plant, such as telpherage systems, and with electric lifts and lifting tackle generally. In regard to elevators and conveyors the need is emphasized for the employment of some device to ensure against the starting of the plant while greasers or repair men are working on it. It is all very well to say " such an accident should have been impossible," but human nature being what it is these things can, and do, happen. In one of the Chadwick Public Lectures, Dr. C. S. Myers, three weeks ago, took as his subject the causes and prevention of human accidents, and stated that at least 80% of fatal accidents are attributable to the " human factor." There are, he said, " accident prone " individuals, but such persons need not always be dismissed from employment. " Their accidents prove to be almost always attributable to special causes—neither carelessness nor recklessness—which can usually be successfully treated, often by appropriate training." In any case, factory workers exposed to dangerous conditions require to be trained in the safe use of machinery and in the purpose of guards installed against danger.

In this connection we would call attention to Mr. Widlake's remarks on the desirability of affording regular opportunities for discussion between the people responsible for the various sections of the works of all measures affecting the personal safety of workers and plant operatives. This, he suggests—and we agree with him—can best be secured by the setting-up of a safety committee composed of the chief officials and the senior foremen or charge hands. Such a committee could meet once a month for the purpose of receiving and discussing accident reports, suggestions, and, in short, all matters bearing upon the administration of safety measures. At such meetings there is ample opportunity for the free expression of individual views, and debatable points can be settled in a far more satisfactory manner than can be achieved by casual discussion between the various people concerned. And it may be observed that the Home Office regard such committees with a considerable degree of favour and view their existence as a proof of a sincere desire on the part of the management to meet statutory requirements.

Bills and Budget

At the moment the Government are enjoying an unusual amount of attention at the hands of the public; for, in addition to the Oil Bill, referred to in the next article, there have been published details of a Coal Mines Bill, a Betting and Lotteries Bill, and a Road Traffic Bill. The Coal Mines Bill is designed to overcome certain of the difficulties which have been experienced in the working of Part I. of the Coal Mines Act of 1930. The Betting and Lotteries Bill deals with many debatable points, and a " stormy passage " seems to be indicated. The proposal to prohibit newspapers from publishing particulars of results of lotteries will relieve the Daily Press of inordinate demands upon its space at certain periods, and will at the same time bring about a more logical position than at present obtains with regard to big sweepstakes. The Road Traffic Bill is the most important of all, inasmuch as it represents an attempt to cope with a most appalling state of affairs. In 1933, a year of peace, not of war, no fewer than 223,530 persons were killed or injured on the roads of Great Britain. This was an increase of 10,413 upon 1932. In England and Wales the number of killed was 6,498 last year, as against 5,962 in the preceding year. Taking the Metropolitan Police District, there was an increase last year in both the number of killed and injured. The killed numbered 1,441 in 1933, against 1,266 in 1932; and the injured 56,912, as compared with 52,447. Readers by this time will have made themselves familiar with the main provisions of the new Bill. The interest of the " Journal " is to do once more what we have on innumerable occasions done before—that is, to emphasize the part which adequate and uniform street lighting can take in promoting the safety of the roads. The possibilities of gas lighting in this regard must never for a moment be lost sight of. Good public lighting is a duty; and " you can do it by gas."

Then there is the Budget, with its unexpectedly large surplus of nearly £40,000,000. There will be many claims to consideration, each and every one having good reason to support it. But we hope that the income-tax payer will be the first to benefit, because we regard his case as going to the very root of our industrial position. It has been urged, and we believe rightly, that nothing would be so widespread in its effect, and so beneficial to all classes, as a reduction in the income-tax. It will be a disappointment if the Chancellor of the Exchequer finds himself unable to do something substantial towards removing the income-tax fetters from industry.

A Petroleum Production Bill

The introduction in the House of Lords recently of the Petroleum (Production) Bill must have recalled to many readers of the " Journal " happenings of years gone by, for the suggestion of oil in Britain is no new one. The present Bill vests in the Crown the property in petroleum and natural gas within Great Britain; but it specifically excepts licences already in force under the Petroleum (Production) Act, 1918, which the new Bill repeals. The expression " petroleum " does not include coal, bituminous shales, or other stratified deposits from which oil can be extracted by destructive distillation; it relates to " any mineral oil or relative hydrocarbon and natural gas existing in its natural condition in strata." The Board of Trade are to have authority to grant licences to seek for petroleum.

Perhaps even prospecting for gold makes less appeal to the imagination than the possibility of striking oil; for with a successful oil strike the transformation of the scene may be much more rapid. Amazing changes have been wrought, as by a magic wand, and may be wrought again. Thus does a writer in one of the Sunday newspapers portray possible happenings in Britain, as the result of successful searching for oil: " In the wild places of Derbyshire new towns will arise out of the barren land. Towns, with churches and cinemas, hotels and banks, shops and police stations, complete towns, and their growth will be startling and romantic." Powerful as is the picture he draws, it is no more than has already happened in America, though in spite of the expenditure of a good deal of money and effort nothing like it has yet occurred in this country.

A schedule attached to the new Bill indicates that there are three licences in force under the 1918 Act. One of these relates to an area near Hardstoft, Derbyshire, another to an area near Heathfield, Sussex, and the third to an area near Three Bridges, Sussex. Hardstoft and Heathfield are places of which in the past a great deal has been heard—the latter in connection with natural gas—while with regard to the third area it is understood that boring has been taking place at Worth, near Crawley. The fact is, however, that no new oilfield has yet been discovered in this country, and some anxiety is felt lest exaggerated reports and irresponsible rumours may jeopardize the Government Bill, and discourage any further search for oil in Britain.

An extensive prospecting scheme was carried out under Government auspices, and by experienced people, in several parts of the country, during, and immediately after, the war, and we would recall a paragraph in the " Journal," dated May 9, 1923. It was in the following terms: " A question was asked in the House of Commons recently as to the cost of the oil exploration that has been carried out on behalf of the State. The information was given that, after allowing for the amounts

realized by the sales of oil, plant, and machinery, the outlay was approximately £564,000. At only two of the eleven borings was oil found in appreciable quantities. Both these wells have been disposed of; and so far as the Government are concerned, the operations are at an end. There has been no pecuniary advantage to the State, beyond the information gained—only loss up to date; and what has been done, it is confessed, was the best way of preventing further loss."

This reference to history is not made by way of discouragement. The importance of petroleum in practical quantities is great enough to warrant any reasonable efforts to secure it, but the subject should be viewed aright.

PERSONAL

Mr. EMILE MOND has been appointed Chairman of the Power Gas Corporation, Ltd., in place of the late Mr. E. Lloyd Pease, and Sir CHRISTOPHER CLAYTON, M.P., has been elected Vice-Chairman in place of Mr. Emile Mond.

* * *

Consequent on the death of Mr. E. Lloyd Pease, Mr. EMILE MOND has been appointed Chairman of Messrs. Ashmore, Benson, Pease, & Co., Ltd., and Mr. WILFRED BESWICK (Managing Director) has been elected Vice-Chairman in place of Mr. Emile Mond.

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Mr. EDWIN THOMPSON, J.P., of Liverpool, has been selected by the Council of the Society of Chemical Industry as President for the year 1934-35. He will take office at the annual meeting of the Society which is to be held in Cardiff on July 16-20. Mr. Edwin Thompson is Governing Director of Messrs. Thompson Capper Wholesale, Ltd., the Liverpool manufacturing chemists, and has for many years been associated with the work of the Society over which he is to preside. He became a member in 1909, has been twice Vice-President, each time for three years, and was Chairman of the Liverpool Section in 1924-25.

* * *

Mr. C. L. W. BERGLIN, A.M.I.Chem.E., of the Leeds Corporation Gas Department, has accepted an appointment on the technical staff of Messrs. Ernest Scott & Co., Ltd., Chemical Engineers, of Westminster, S.W. 1. Mr. Berglin was on the staff of the Brisbane Gas Company, Australia, which he left in 1931 to come to England under the auspices of the Australian Universities' "Passage Grant" scheme for the purposes of furthering his chemical engineering experience. While in this country he has been attached to the technical staff of the Leeds Corporation Gas Department.

* * *

Mr. FREDERICK PYNER, a member of the staff of the Gas Light and Coke Company at Beckton, has been elected an Independent member of Barking Borough Council.

OBITUARY

The death has taken place, at the age of 92, of Mr. JOHN GREEN, of Whitford, Bromsgrove. He had been a Director of the Bromsgrove Gas Company since its formation in 1869 and Chairman since 1886.

* * *

The death occurred last week, at the age of 79, of Mr. THOMAS POOLE, a former Mayor of Oswestry. He was a prominent public man, and was Chairman of the Oswestry Gas Company.

* * *

The death occurred at a London nursing home on March 29 of Mr. WALTER NEWTON DREW, J.P., of "Ramcliffe," Ecclesfield, and "Ringrove," Salcombe. Mr. Drew was Pro-Chancellor of Sheffield University, and Chairman and Managing Director of Messrs. Newton, Chambers, & Co., Ltd., and Sheffield and Thorncliffe Coal Distillation, Ltd. The interment took place at Ecclesfield on April 3.

THE NEWS OF THE WEEK

The Dunfermline Town Council have decided to purchase Tulliallan gas undertaking, owned by Fife County Council, for £1,000.

We Regret we were in error in stating in the "JOURNAL" for March 21 that the Nelson Corporation is considering a site for new gas-works in Bradley Road.

Gas Undertakings Bill.—The text of the Gas Undertakings Bill as brought from the House of Lords is now available and can be obtained from H.M. Stationery Office or through any bookseller (price 9d. net).

The Extraction of Benzole from coal gas has been commenced at the St. Helens Corporation Gas-Works. At the present time about 200 tons of coal per day is being carbonized, and about one gallon of crude benzole per ton of coal used is extracted.

Principals and Officials of the new Clyde Valley Gas Supply Company, Ltd., which is to supply tomato growers in the Clyde Valley area, paid a visit to the Arbroath Gas-Works recently, where they saw much that interested them, and views were exchanged on the use of gas for glass-house heating systems.

Southern Association.—By kind invitation of the Governor and Directors of the Gas Light and Coke Company, members of the Southern Association of Gas Engineers and Managers will visit Watson House and the Fulham Stove Repair Shops on Friday, May 25. The members will assemble at the Head Office, Horseferry Road, at 10 a.m. and be conveyed by motor coach to Watson House. Lunch will be served at the Head Office, and afterwards the members will be taken to the Fulham Stove Works where tea will be provided.

The Centenary was Celebrated by the Maybole (Ayrshire) Gaslight Company, Ltd., last week by an exhibition of gas appliances in the Town Hall. In declaring it open, Mr. Thomas Smith, Chairman of the Company, reviewed the history of the concern and said that in the 100 years the service had never once failed the public.

Welding Handbook Re-Issued in Enlarged Form.

A revised and enlarged edition of "Procedure Handbook of Arc Welding Design and Practice" is announced by the Lincoln Electric Company, Cleveland, Ohio. The book has been re-issued because of the demand which exhausted the original issue published last autumn.

The new volume contains over 450 pages with several hundred illustrations. The eight principal sections deal with various phases of arc welding in a simple, concise manner, well illustrated with detailed drawings and photographs. Taken together, they cover practically every use and application of arc welding.

To make the book convenient for both desk and shop use, it has been made 5¾ by 9 in. and bound in semi-flexible simulated leather. A comprehensive index has been included. Copies will be mailed post-paid in the United States by the publisher for $1.50 per copy. Foreign postage 50 cents extra. Buck & Hickman, Ltd., of 2, Whitechapel Road, London, E. 1, are English representatives of the Lincoln Electric Company.

THE NEWS—continued.

SIR ARTHUR DUCKHAM MEMORIAL FUND

Official List of Donations from March 24 to 29

The Committee hope to be in a position to endow a "Duckham Research Award," to be applied for the period and purpose of specified investigations of interest to the Gas Industry, at places, at home or abroad, selected as being appropriate for the conduct of each particular investigation. Subscribers, therefore, are not only paying a tribute to the memory of Sir Arthur Duckham, but are also assisting to strengthen the Gas Industry at a critical period of its development.

Name and Town.	Amount. £ s. d.
Alloa Town Council Gas Department	10 0 0
G. W. Allott, High Green	1 0 0
"Anonymous" (376), London	1,050 0 0
Babcock & Wilcox, Ltd., London	105 0 0
Miss Bishop, Mr. Oliver, and Mr. Styles, London	0 10 0
J. & J. Braddock, Manchester	10 10 0
Bradford Corporation Gas Committee	46 11 0
H. A. Brassert & Co., Ltd., London	21 0 0
Bridgend Gas Company	1 14 0
British Export Society, London	2 2 0
Chertsey Gas Consumers' Company, Ltd.	6 9 0
Dugald Currie, South Shields	2 2 0
Devon Gas Association, Ltd., Exeter	2 2 0
Eastbourne Gas Company	5 5 0
J. Mason Frith, J.P., Buxton	1 1 0
Gas Light and Coke Company	1,300 0 0
Gas News, Hinckley	1 1 0
Gibbons (Dudley), Ltd. / Gibbons Bros., Ltd.	50 0 0
Godalming Gas and Coke Company, Ltd.	4 0 0
Greenock Corporation Gas Department	25 0 0
Hampton Court Gas Company	24 12 0
Hartlepool Gas and Water Company	5 5 0
John G. Henderson, Esher	0 10 6
D. M. Henshaw, Huddersfield	5 5 0
Herne Bay Gas Company, Ltd.	7 7 0
R. Horsler, Sidcup	0 5 0
Ilfracombe Gas Company	5 3 0
Institution of Chemical Engineers, London	10 10 0
Dr. C. H. Lander, C.B.E., London	2 2 0
Donald Macpherson & Co., Ltd., Manchester	10 10 0
Sir David Milne-Watson, London	10 10 0
J. W. Napier, Alloa	2 2 0
Normanton Gas Company	4 0 0
George Orme & Co., Manchester	5 5 0
Petersfield and Selsey Gas Company	1 11 6
Radiation, London	250 0 0
Sawer & Purves, Manchester	5 5 0
J. Sheridan, London	1 1 0
Solihull Gas Company	2 2 0
South Yorkshire Chemical Works, Ltd., Park Gate	5 5 0
Stewarts & Lloyds, Ltd., Birmingham	15 15 0
Sunderland Gas Company	45 0 0
A. G. Sutherland, Ltd., Birmingham	5 5 0
Wakefield Gaslight Company	5 0 0
Winchester Water and Gas Company	10 10 0
Henry Woodall, London	10 10 0
W. W. Woodward, Salford	2 2 0
Workington Corporation Gas Committee	5 0 0
Donations (48) paid above	£3,103 0 0
Donations (342) paid previously	4,559 1 0
Total Donations (390) paid	£7,662 1 0
Donations (18) promised	1,117 4 0
Total Donations (408) paid or promised	£8,779 5 0

Holmes' Calendar for 1934.

The second of the new series of "Pioneer" illustrations which are such an interesting feature of the calendar of Messrs. W. C. Holmes & Co., Ltd., is a diagrammatic drawing of Clegg's limewater purifier at Stonyhurst College, 1807.

This method of purification appears to have been universally adopted very soon after its first introduction and continued in use until solid lime and oxide purifiers were introduced.

The illustration is reproduced along with descriptive matter, and the calendar covers the April-June quarter.

The Gas Industry as a Career.

"The Gas Industry as a Career for Boys" was the subject of an address by Mr. E. L. Oughton, of the South Suburban Gas Company, to the Parents' Association of the Bromley County School for Boys at the school recently.

He realized fully, he said, the anxiety of parents for the future of their boys, particularly in these days of social and economic upheaval with its increasing uncertainty of suitable employment. A heavy responsibility rests with the headmaster in recommending a boy for any career, but he has had the opportunity of studying the characteristics, capabilities and aspirations of the boys under his charge in a way and to a degree that parents can never have. In general terms, there are boys born to control, to be administrators and executives; then there are others with analytical minds for scientific research, invention, engineering, salesmanship, and skilled craftsmanship. These are general examples of openings, and boys with special characteristics who are given suitable opportunities will make a success in life each in their special sphere—otherwise it will probably mean failure.

The Gas Industry afforded scope for boys with the ability to fulfil any of the foregoing. With the exception of casual labour for seasonal work, there was no industry less subject to uncertainty of employment. Many gas companies had schemes of co-partnership which were formulated to foster a mutual relationship and interest between the staff, workmen, and the directors of the companies, and by which employees become shareholders themselves.

A scientific industry, such as the Gas Industry, had a definite need for technically and commercially trained men in its research laboratories, manufacture, distribution, and utilization.

There were opportunities in the Gas Industry for every type of youth, whether he be primarily educated at the elementary, central, secondary, or public school, or the university. The subsequent training was governed by two general factors: (1) Primary education; (2) the section of the Industry entered, which may be commercial, technical, or practical.

The South Suburban Gas Company had a technical training scheme for the whole district staff. The younger members of the staff were advised regarding appropriate courses of study, and assisted with the cost of fees, &c. Lectures were given to the various grades of staff so that the Company's business may be carried out efficiently.

The secondary school boy could enter the Company's service by way of commercial or practical work, and carry on his studies concurrently with his daily work. So far as the district staff were concerned, he could then be drafted for district work, showroom work, depôt duties, canvassing, assistant inspector's and inspector's work, &c., according to his ability and personality.

To make real progress on the commercial side, the study of economics, accountancy, and commerce was essential, and there were many good positions in the secretarial and accountancy departments. The technically-minded youth had opportunities and scope whether on the gas manufacture or the distribution side. On the works engineering side there were openings for assistant engineers and managers, chemists and technical assistants, draughtsmen, &c.

THE NEWS—continued.

Watford and St. Albans Centenary.

Distinguished Guests Attend Celebration Luncheon.

In the "JOURNAL" for March 21 we referred to a notable centenary in the Gas Industry which is being celebrated at the present time—namely, that of the Watford and St. Albans Gas Company. On that occasion we drew attention to an attractive brochure which had been published by the Company in commemoration of the anniversary, and in the course of a few excerpts therefrom indicated something of the early history and development of this progressive undertaking.

In further celebration of the occasion a luncheon was given on March 23 at Buck's Restaurant, Watford, when upwards of a hundred guests, representative of the Gas Industry, local authorities, and principal consumers, were entertained. Mr. Frank H. Jones, Chairman of Directors, presided.

Among those present were Viscount Cecil of Chelwood, Sir Dennis and Lady Herbert, the Mayor of Watford, the Mayor and Mayoress of St. Albans, the Mayor and Mayoress of Hemel Hempstead, Mr. H. Woodall (Deputy-Governor, Gas Light and Coke Company, and Managing Director of Tottenham and District Gas Company), Mr. C. M. Croft (General Manager, Wandsworth and District Gas Company), Mr. W. Rowe (British Commercial Gas Association), Mr. J. Ramage (Secretary, Industrial Co-Partnership Association), Mr. H. C. Smith (Chief Engineer, Tottenham and District Gas Company), Mr. J. F. Haseldine (Engineer and Manager, Barnet District Gas and Water Company), Mr. G. Evetts, together with members of the staff of the Watford and St. Albans Company, including Mr. G. Wilks (Secretary and Commercial Manager) and the various works engineers.

Viscount Cecil of Chelwood, proposing "The Watford and St. Albans Gas Company," said that it was his duty and pleasure to put before them the principal toast of the proceedings. For many reasons he was grateful to the Company for having asked him to propose that toast. For one thing, it was very pleasant in these days to have anything to do with an industry that was definitely prosperous. The Company of which they were celebrating the centenary had its beginning in a town of about 3,000 inhabitants. The town had now, he believed, some 60,000 inhabitants, and the area of the Gas Company was very much larger than the town. He did not know exactly the population which it supplied, but he supposed it would be safe to say that it supplied at least double the population of the town—a population of something like 120,000. Its capital had grown proportionately. It began with a capital of £2,500; to-day its capital was £1,200,000. Its growth had been the growth of Watford.

CO-PARTNERSHIP.

But to him the most interesting feature of the Industry had always been its adoption of the principle of co-partnership. That, of course, was primarily connected with Sir George Livesey. In 1883, after many labour troubles in the management of the South Metropolitan Gas Company, he instituted the principle of co-partnership, with great difficulty, and after a great struggle with the leaders of Labour at that time, who entirely misunderstood his objects and purposes. It was true to say that from that time forward there never was any serious industrial trouble in his Company. He believed there had never been since. That was an immense thing to say. The example of the South Metropolitan Company was gradually followed by other Companies, including the Watford Gas Company, until—and he had asked one who knew—he believed it was safe to say that taking the Gas Companies—apart from the local authorities—70% were now managed under co-partnership principles.

The Chairman, in acknowledgment, said that on behalf of the Company he thanked Lord Cecil for his remarks, and all present for coming to take part in their "birthday" party. Their area of supply extended nearly to Hertford, to Hatfield and Welwyn, and Elstree, Hemel Hempstead, and from the following Wednesday they would be supplying Rickmansworth. Many years ago they came to the conclusion that it would be a wise thing to adopt co-partnership; in fact, that was one of the terms of service in the Company, that after a man had been with them a certain time and had proved himself worthy he had to join the pension fund.

As one who had been connected with the Company for 38 out of its 100 years, he wanted to tell them that there was a great romance in the Industry. For 100 years those works at Bushey Arches had been making gas all the days of the week, 24 hours of the day. Never had the work stopped. And the Industry had been developed from serving the little town of Watford to covering the greatest part of Hertfordshire.

Mr. Henry Brown (Deputy-Chairman of the Company) submitted the toast of "The Guests," which was responded to by Sir Dennis Herbert.

An Exhibition at Lancaster.

Our photograph is of the display of the Lancaster Corporation Gas Department at a recent exhibition. An excellent show of "New World" cookers was made. In the foreground of the stand can be seen two of the new "Health Ray" heaters.

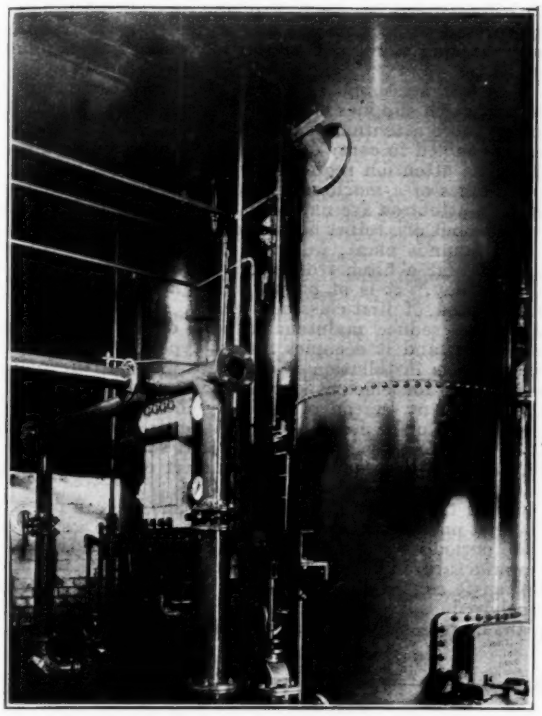
"Municipal Year Book," 1934.

The 1934 edition of the "Municipal Year Book" surpasses all previous issues both in size and in the comprehensive material which it contains. The volume, which runs to 1,527 pages, has been extended this year from 37 sections to 45. Various improvements have been effected. While all previous features are retained, new sections deal with, among other subjects, digest of law cases affecting local government during the year; slum clearance; museums and art galleries; and fire services. The book gives particulars of all local authorities in England, Wales, Scotland, and Ireland; names and addresses of members of councils; names of chief officers; population, rateable value, rates in 1933-34, and numerous other particulars concerning county, borough, urban, and rural districts.

Names of chief officers of Government Departments concerned with local administration are given fully. Sections of the book deal with every phase of local administration, among the more prominent being roads and transport, street lighting, housing, town planning, education, public assistance, public health, finance, legislation affecting local government, public libraries, parks and open spaces, public cleansing, mental health services, markets and slaughterhouses, police services, &c. The recent alterations of local government areas under the Local Government Act, 1929, are detailed.

Twenty pages are devoted to a succinct yet comprehensive review of outstanding features of local government in 1933. It is noted that the year will remain memorable as a year of consolidation, for it witnessed the achievement of the first instalment of the process of tidying up the law of local government. The passing of the Local Government Act, 1933, is described as a momentous event, involving, as it does, the codification and reduction of numerous statutes to one homogeneous law, producing a large measure of legislative uniformity.

The "Municipal Year Book" is published by the Municipal Journal, Ltd., 3 and 4, Clements Inn, Strand, London, W.C. 2, price 30s. net.



The Lowe (New Zealand) Automatic Blue Water Gas Plant at the Raunds Works.

A PIONEER AMONG SMALL GAS UNDERTAKINGS

NEW CONTINUOUS FLOW AUTOMATIC WATER GAS PLANT

Increased efficiency and improved methods of production at the smaller gas-works have latterly received considerable attention. Until recently the relatively high capital outlay and operating costs associated with hand-operated water gas plants of small capacity have been a deciding factor against the incorporation of the dual method of manufacture by the smaller undertakings having re-organization or extensions under consideration.

Recent developments, particularly as regards automatic operation, have, however, altered this aspect, and it is now possible for concerns with an annual make of twenty millions, or less, to install water gas plant and obtain carbonizing results which bear comparison with those of the larger undertakings.

During the past seven months a small automatically-operated blue water gas plant has been in commission at the works of the Raunds Gas Light and Coke Company, Ltd., and has received the blessing of the Engineer, Manager, and Secretary of the Company, Mr. W. Bolton, who, when we visited Raunds to inspect the installation, expressed himself as being highly satisfied with this addition to the works.

A Plant New to This Country.

The plant is of particular interest as being the first of its type to be erected in this country. It was installed by Messrs. Davison & Partner, Ltd., of Westminster, who have obtained the British manufacturing rights from the Patentee, Mr. James Lowe, of Auckland, N.Z. The plant is known as the " Lowe " (New Zealand) Patent Automatic Blue Water Gas Plant, and although, as previously mentioned, it is the first English installation, a number of installations on the same principle have been successfully operating for some years in New Zealand.

The Raunds plant has a nominal capacity of 60,000 c.ft. daily, and has been evolved specially to meet the demand of the smaller gas-works. The plant consists of two generators, with refractory linings, renewable inner linings at the heat zone, and insulating material encased in mild-steel shells, the upper portion of each generator being extended to form a super-imposed coke storage hopper sufficient for an eight or twelve hour supply of fuel while operating at full capacity. Bracketed to the top of the generators is the charging floor complete with hand-railing, access stair, and coke charging gear. The generators are fitted with the usual gas, blast, and steam valves, coke charging and ash removal doors, and offtake pipes for delivering the gas into a common washer, the latter being fitted with effluent overflow and seal pot. The gas and blast valves are safely interlocked and are worked by means of an hydraulically operated cylinder, a secondary cylinder actuating the generator steam supply valves, simultaneously. All valves are common to both generators and consequently interchangeable.

Continuous Gas-Making.

The gas-making and blowing periods of the cycle are equal, the process of each generator being reversed at the same moment; and, since one generator is gas-making at any given time, a continuous flow of gas of regular quality is produced. As an emergency measure, for instance, during repairs to one generator, the other may be run automatically for as long as required by the simple removal of a bolt from the operating gear. This expedient is of great advantage should occasion arise to carry out immediate repairs, and it eliminates the necessity of a complete shut-down, as would be the case with a single generator plant.

The change-over from " run " to " blow," or *vice versa*, is carried out by the reversal of hydraulic flow to the valve operating cylinders, and is effected by means of an hydraulic control valve, which in turn is operated by an extremely simple form of mechanically-driven timing mechanism. This machine actuates the control valve, so as to operate the valves in correct sequence, and is arranged to give variations of the cycle to suit the characteristics of the fuel being used. By disconnecting the control valve from the automatic operator the plant may be hydraulically operated by hand if required.

Hydraulic power is supplied by means of a pump of ample capacity, although actually the operating cylinders have been so designed that with a town's main supply of water of moderate pressure, the pump could be dispensed with, or retained as a stand-by in cases of emergency. We are informed that a number of the Lowe automatic plants already installed in New Zealand use the town's water supply for this purpose.

The power required for the operation of the water pump, automatic operator, and air blower, is supplied by a vertical gas engine of the totally enclosed, self-lubricating type, which has proved to be thoroughly reliable. It is understood, however, that alternative steam engine or power driven units can be supplied by the contractors if required.

The plant is complete with all controlling and metering devices, including steam meters, steam, gas, blast and hydraulic pressure gauges, all neatly assembled on a standard gauge board, mounted between the generators, as can be seen from our illustration. The steam and air regulating valves are so arranged that the operator has the gauge board and instruments directly under his observation when making any necessary adjustment to the steam or blast rates.

An Important Advantage.

From the washer outlet the gas goes forward to the coal gas plant, or, by means of a two-way connection and regulating valve, a proportion of the make is passed into an existing relief holder, thus giving sufficient storage for the night shift, in which event the plant is shut down overnight. It may be mentioned that due to the plant being of the continuous flow type, controlled amounts of water gas can be passed direct to the coal gas plant without interfering in any way with the normal working of the retorts, or the

quality of the mixed gas, which conditions are difficult of attainment in the case of an intermittently-operated water gas plant.

Although this particular plant is arranged normally to work into the existing relief holder for overnight storage purposes, experiments were conducted whereby the whole of the make was passed to the coal gas installation with no interference with the operating of the carbonizing plant. This feature deserves emphasis. Actually all the Lowe plants in New Zealand are operating successfully on this principle.

In accordance with the routine practised at the Raunds Works, the fires are well pricked up and ashed out, the generators and coke storage hoppers charged, and the plant started up each morning. After the steam and blast rates have been adjusted to give the required production, the plant, being entirely automatic in operation, requires no further attention during the shift. At the end of the day's operating the plant is shut down until the following morning, when the fire cleaning and charging operations are carried out as before, and the unit is again put to work. Clinker formation—as we were able to appreciate during our visit of inspection—is practically negligible.

Flexibility of Operation.

The plant can be operated at reduced output as required, the steam and air regulating valves being readily adjustable. For instance, when working at 50% capacity the plant, after starting up, will run twice as long as on full capacity, without further attention. Since being installed it has been operated on various cycles, the output forced, worked on normal production, and at various reduced outputs down to as low as 25% of the guaranteed production figure, and at no time has any difficulty been experienced in producing a regular supply of water gas of uniform quality.

The low steaming rate necessary impressed us. The boiler, which supplies steam for the plant and works, calls for no more attention than before, the retort house stoker being enabled to carry out his normal duties in addition to the little attention required by the water gas plant. The advantages of a machine of such flexibility, and requiring so little attention are naturally appreciated by Mr. Bolton, who has but one retort house stoker on duty.

The Raunds plant, we were told, has worked smoothly and without a hitch from the time of starting up to the present day. It is of pleasing design, British made, and constructed of first-class materials. It is essentially designed to reduce maintenance and operating costs to a minimum, and it occupies for its type very little ground space. The installation is complete with all the requisite accessories for efficient operation, and on account of its simplicity any person of ordinary intelligence can be instructed as to the method of operation in a very short time. It appears to us as a proposition that should appeal to the smaller concerns requiring a non-inert diluting plant at a moderate capital outlay.

Owing to the short time the plant has been in operation, it is not possible to give production costs over a sufficiently wide period as a comparison with the previous method of manufacture, but from preliminary estimates made by Mr. Bolton it can be stated that carbonizing costs have been much reduced, and the thermal production of the whole plant increased by more than 10%.

Fatal Gas Explosion at Gateshead

Question of Liability Argued

A test case of considerable importance was decided in the High Court on Wednesday last by Mr. Justice du Parcq. It appeared that Mrs. Sarah Davenport, a widow, of Calville Street, Gateshead, sued the Gateshead Corporation, one of their contractors, Mr. J. A. Duncan, and the Newcastle and Gateshead Gas Company for damages for the death of her husband, and expenses to herself and her infant son caused by a gas explosion in Calville Street which wrecked her home.

The hearing of the action was commenced by his Lordship at the Newcastle Assizes some time ago, and he remitted it to London for the purpose of hearing legal arguments.

Making his submissions on behalf of the Corporation, Mr. Paley Scott, K.C., explained that Mr. Duncan used a heavy excavator or mechanical "navvy" to pull up the road, and the machine ripped a gas pipe from the main and the gas ignited and there was an explosion which did considerable damage.

Counsel said allegations of negligence were made against all the defendants, and the question which emerged was whether the gas pipe was laid at a reasonable depth so as normally to escape repairs to the road, and could Mr. Duncan, as the Corporation contractor, have found the pipe had he used reasonable care and inquiry?

Counsel contended that his clients were entitled to rely on the assumption that the Gas Company laid their pipes at a safe depth and upon an understanding which existed between gas companies and local authorities as to the depth at which such pipes should be laid. Mr. Paley Scott suggested that if the Corporation lost this case the result would be that such local bodies would not be able to rely on gas undertakings doing what was generally accepted to be their duty, and the burden would be placed on local authorities of supervising the laying of gas pipes.

For Mr. Duncan, Mr. Willoughby Jardine, K.C., emphasized that his client made adequate inquiries with regard to the mains, and was entitled to expect that his work would not interfere with or damage any such pipes.

Mr. M. Schiller, K.C. (for the Gas Company), argued that the other defendants had assumed that, so far as gas pipes were concerned, they need not give notice of their intention to break up the road. The Corporation seemed to think it was no business of theirs, and that had notice been given nobody would have bothered about it. His contention was that the Corporation should have made all inquiries as to exactly where the pipes were. They certainly should have taken steps to ascertain whether any pipes were in the road. Instead, they went on with the work and, above all things, used a heavy excavator.

In his judgment, Mr. Justice du Parcq repeated the gist of the legal submissions, and remarked that he was disposed to think it would have been better had the Gas Company exhibited a record of the whereabouts of the pipe, apart from any statutory obligation which was upon them, and to have informed the Corporation about it. Apart from that, however, he did not think there was any negligence in the laying of the pipe. But he did think, when the time came to make up the road, it would have been better had the Gas Company told the Corporation of the existence of the pipe. He could not say that a mechanical excavator should not have been used, although the person using it should have had in his mind that, if it caught in anything in the road, the consequences of its contact might be much more serious than that which would arise from the use of tools in human hands. The Corporation, his Lordship proceeded, had submitted with force that they were entitled to assume that there could be no pipes so near the surface as 2 ft., and for that reason they argued that neither they nor their contractor could be held to be responsible. His Lordship considered that the Corporation and the contractor should have been aware of the possibility of mains being in the street, seeing that there were buildings there which took a supply of gas. It was an excellent principle that no pipe of that description should be laid at a less depth than 2 ft., but there was no definite or established rule about it, and he was surprised in that case that so little was done in the matter of inquiry or getting information. He considered the Corporation most clearly should have made some inquiry of the Gas Company. It was no answer to venture the suggestion that, had inquiry been made, the Gas Company would not have troubled to vouchsafe information. That was a mere matter of speculation, and the probability was that the Gas Company would have given the information required.

His Lordship thereupon decided that the Corporation and Mr. Duncan were liable to meet Mrs. Davenport's claim which he assessed as follows:

£500 for the loss of her husband (and of that sum £180 should go to the infant child); £600 for personal injuries to herself and £10 to the child; and £60 damages for the injury to the property which had been wrecked. He also gave plaintiff costs of the action.

Dealing with the position of the Gas Company, his Lordship remarked that that concern claimed that they were not negligent, and if they were, their negligence did not cause the disaster. He hoped that, if there were any local authorities or gas companies in the country who had taken the same view as the defendant Company had about the meaning of the relevant section of the Gas-Works Clauses Act their minds would be disillusioned by the knowledge that all the learned Counsel who had appeared in this action had agreed that there could be no question about the duty of a gas company to give notice of the whereabouts of their pipes when road breaking operations were in progress. Had the law thus been read by the Gas Company here this tragic misfortune might never have occurred. That was a sad reflection. However, he was convinced that the pipe was never dangerous until the Corporation and its contractor made it so by opening the road with the excavator; and although the Gas Company could not escape criticism, they were not, in his opinion, liable for damages.

His Lordship thereupon entered judgment for the plaintiff against the Corporation and Mr. Duncan on the terms he had indicated.

Gas Cut-Off Safety Device for Calorimeters

From Mr. A. L. Norton, of the Redditch Gas Company, we have received the following account of a gas cut-off safety device for water flow calorimeters. It was patented in November, 1931—B.P. No. 385,084. Its working will be understood by reference to the accompanying diagram.

The gas from the official installation diaphragm governor flows through 3, down 11, up annulus 10 to the test meter. A sealing chamber is shown at 9. The difference in water levels A and B is obtained by momentarily opening tap 12 to atmospheric pressure and then closing.

The waste water from the change-over funnel is directed into limb 1, which is in communication with sight tube 5 through passage 6 and with limb 2 through tap 13. The orifice 7 determines the levels of water in 5, 1, and 2, and the sight tube 5 is graduated in c.c. flow per minute.

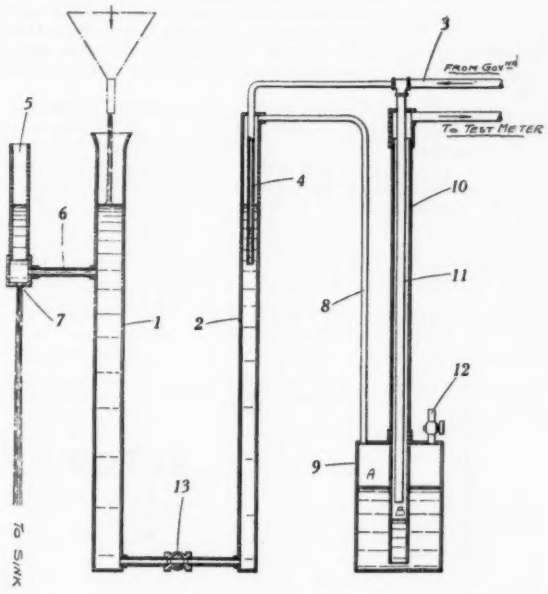
Limb 2 has a dip pipe 4 (connected with gas supply 3) which normally is sealed, but if the water flow into tube 1 becomes restricted or ceases, then water levels in 5, 1, and 2 will fall due to drainage at orifice 7, and so unseal pipe 4, thus admitting gas through pipe 8 into chamber 9, causing water level A to fall and B to rise in annulus 10, and so seal off the gas supply pipe 11, which is the gas supply to the test meter and calorimeter.

Any subsequent creeping of gas pressure past the diaphragm governor will further increase the height of this water column in 10.

The gas supply to the calorimeter will remain cut off until vent tap 12 has been opened and the water level restored in 5, 1, and 2 to re-seal the dip pipe 4. The tap 12 must then be closed. During a test for calorific value, and also before shutting off the calorimeter, tap 13 is closed, so as to maintain the seal in limb 2.

This device has been designed with particular care to avoid the inclusion of any moving mechanical parts, and to operate not only if the water has ceased to flow through the calorimeter coils, but also if such flow falls slightly below the specified minimum rate of water flow it thus completely avoids the possible ill-effects of over-heating the thermometers or calorimeter coils.

After the gas " cut-off " has operated it is found that the outlet thermometer reading is increased by barely 1° C. In putting the calorimeter to work it will be appreciated that the time-wasting and unsatisfactory method of determining the water flow by stop watch and measuring glass is eliminated, because the water flow is immediately indicated, and can instantly be adjusted after observing the level in the sight gauge 5. Moreover, a fluctuating reading of the outlet thermometer will not erroneously be attributed to a fluctuating calorific value, because the water level in the sight gauge will also fluctuate, and if there is a slight air lock or other obstruction in the calorimeter coil it will cause such temperature fluctuations.



The apparatus described has been in almost daily use for three years, during which time no repairs have been necessary to the calorimeter.

The calorimeter parts 1 and 5 are positioned immediately under the calorimeter change-over funnel waste pipe connection. The connection between limbs 1 and 2 is of sufficient length to allow the gas " cut-off " part of the apparatus to be fixed between the installation diaphragm governor and the test meter.

Gas Heating for Churches

Bulletin de l'Association des Gaziers Belges, 1934, **16**, 13-15 (Jan. 15), reproduces a paper by F. Kaiser on the use of gas for the heating of churches and acknowledges *Das Gas- und Wasserfach* as the source of the information.

The author is a member of the staff of Eisenwerk G. Meurer A.G., of Cossebaude, gas heating specialists. He states that competitors of gas heating often have exaggerated ideas of the amount of gas required for this purpose and instances the case of a new Catholic church at Ludwigshafen. Though his firm put forward a scheme of gas heating based on a consumption of 162,000 c.ft. of gas per year, two advocates of other methods of heating would not credit this and respectively denied that less than 880,000 and 617,000 c.ft. would suffice. Gas heating, however, gained the day, and, in actual fact, but 108,000 c.ft. of gas was used during a year.

The reason for the smallness of the amount of gas required for the heating of such buildings as churches where heat is required for but short periods is that gas radiators do their work very quickly—namely, in an hour, or in two hours at a maximum. Hence the walls, floor, and contents become heated only in their outermost layers. Where slow methods of heating are employed more fuel is needed.

The Meurer Company has so far installed gas heating equipment in approximately 350 churches of various denominations in Germany, Holland, and Czechoslovakia. Cast-iron radiators are always employed. Reports are available from 41 of the churches. The internal volume of the churches ranges from 18,000 to 670,000 c.ft.; the annual gas consumption from 16,000 to 480,000 c.ft., and the annual consumption per c.ft. of volume from 0·33 to 2·13 c.ft. with an average of 1·0 c.ft. The high figure of 2·13 c.ft. is due to the fact that a temperature of 64° F. is required in the church concerned. Small churches might be expected to show a proportionately higher specific consumption than larger churches, but this is not always the case, due partly to the fact that small churches are generally more fully occupied, with the result that relatively more heat is given up from the bodies of the congregants, and partly to the fact that the buildings are not so high—a fact which reacts favourably on the gas consumption. Other differences in the consumptions of different churches are explained by the fact that the calorific value of the gas varies from place to place.

In view of the fact that Catholic churches are heated each day, since they are attended for the purpose of Mass and Confession, it might be expected that their gas requirements would be larger than those of churches of other denominations. This is, however, not the case, since Catholic churches are generally content with a lower temperature. Moreover, when gas radiators are employed, only those actually in the parts of the building in use at the moment need be at work.

In view of the economies arising from rapid heating, it is an advantage that gas radiator installations should be liberally designed, though, of course, there is an economic limit on grounds of capital cost. The most favourable design is one which enables heating to be effected in a period of 1½ hours even in cold weather.

In general, the highest consumption of gas for space heating occurs in January and February. In churches, the maximum consumption is in December, due to the large number of services associated with Christmas.

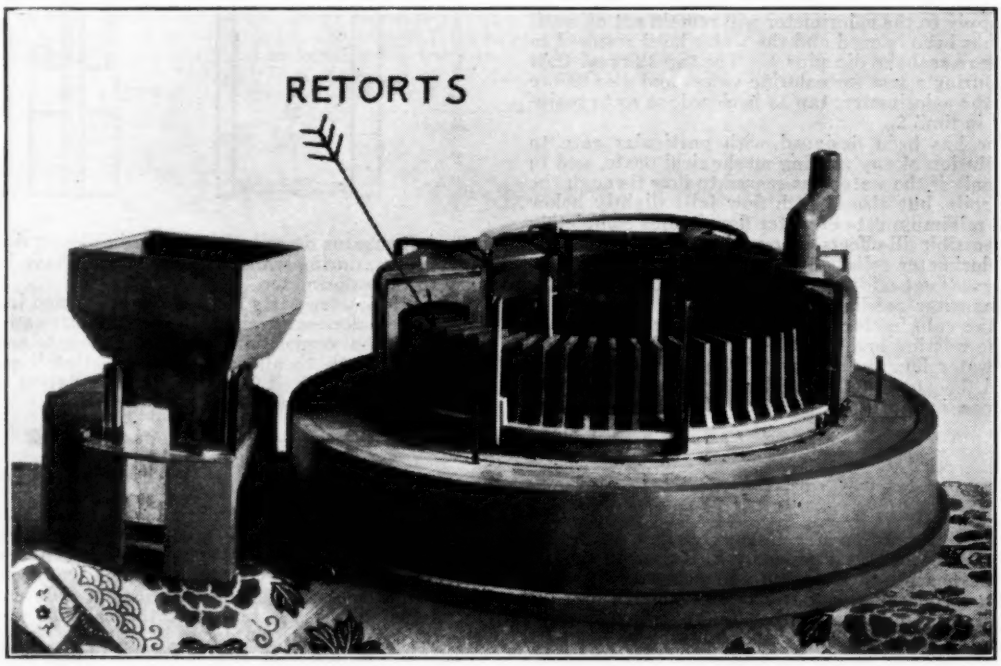
An example of the great advantages of gas for the heating of churches is given. With an external temperature of 30° F. and an internal temperature of 34° F., the temperature of a church having a volume of 247,000 c.ft. was raised to 54° F. in one hour with an expenditure of 2,120 c.ft. of gas. On a night in December when the thermometer registered 9 degrees of frost, the radiators were lit at 11 p.m., and at 1 a.m., the sacristan having forgotten to turn them off, the temperature in the church reached 62½° F., the gas consumption having been 3,180 c.ft. Even opponents of gas heating were convinced, as they opened their coats and removed their gloves, that gas heating is indeed effective.

Low-Temperature Carbonization

A Continuous Rotary Carbonizing Oven

We have had brought to our notice a patented system of low-temperature carbonization with many unusual features. It is known as Winser's rotary continuous low-temperature carbonizing oven, and a brief description of this novel method of attacking a hoary problem may interest our readers.

The aim of the continuous process is to ensure uniformity of products and a satisfactory throughput. A Winser oven for a throughput of 60 tons a day would have a diameter of about 40 ft. Though no plant is yet operating on the principle, in our description we assume this capacity. According to the invention (that of Mr. C. B. Winzer) half of the circumference consists of the heating chamber, and the other half is a cooling-down chamber. Further cooling of the resulting smokeless fuel is accomplished in the bottom part of the oven into which the containers are emptied, where it cools down sufficiently to be loaded when withdrawn into railway trucks, &c.



PHOTOGRAPH OF A MODEL OF THE WINSER CONTINUOUS ROTARY CARBONIZING OVEN, GIVING AN IDEA OF THE CONSTRUCTION.

By employing a pre-heating zone, a coking zone, and a cooling zone, the oven will, it is claimed, ensure a high degree of uniformity of the smokeless fuel and oils, giving the mild heat time thoroughly to penetrate the charge. The heat is then gradually withdrawn so that the external portions of the charge are not overcoked. About 60 containers are permanently fixed on a hearth around the circumference of the oven. The measurements of these are about 5 ft. 6 in. in height by 4 ft. wide by 7 in. across, with a centre cast-iron plate. Each container holds a charge of about 5 cwt. of small coal, or 2 layers of coal of 5 ft. by 4 ft. by 3 in. When carbonized these two layers form two slabs of smokeless fuel weighing about 1¾ cwt. each. Since the containers are only about 5½ ft. in height and sharply tapered, it is claimed that the slabs will through their own weight fall readily into the cooling pit when the bottom doors of the containers are opened by means of hand levers.

The heating and cooling sections of the tunnel of the oven are constructed of cast-iron sections and plates firmly bolted together, allowance being made for any heat expansion of the entire circle in the cool section of the oven. The heating part is lined with suitable firebrick lining. In the arch of the heating tunnel a combustion chamber is formed, where the gas for heating the oven enters. Burners are situated at equal distances. The heating gas is conducted to the burners by pipes which rotate in connection with a rotating valve when the travelling tunnel is moved about every 20 minutes the distance of 3 containers (about 3 ft.). The moving of the oven tunnel is accomplished by a small electric motor of 1½ h.p. During each interval of about 20 minutes 3 containers are emptied of their smokeless fuel and filled up again with fresh charges of small coal. The latent heat of the containers, which never quite cool down, is economically employed for advance warming-up of the fresh coal charges.

The products from the combustion chamber travel downwards at each side of the heating tunnel through flues, the hot gases rising through portholes into the heating chamber proper. They first supply bottom heat to the containers, and then rise between them and surround them. The containers, in fact, act as heat baffles. The heating gases find their exit into chimneys fixed on the top of the heating chamber, the chimneys being provided with dampers to regulate draught conditions.

The cooling chamber of the oven is lined with common firebrick. The cooling pit of the oven consists of a circular conveyor, which is water-cooled and can be rotated to a door situated at a convenient place of the oven whence the cold smokeless fuel can be loaded into railway trucks, &c. The heat given off is conveyed to the cooling water, and this, it is suggested, can be used for boiler or other purposes.

The gaseous products evolved in the process pass to the top of the coal containers. Thence they are led through pipes to the mains from where the vapours pass into a common pipe situated underground all round the circumference of the oven. From here they pass to the bye-products plant.

At the cool section of the tunnel where the coal is charged into the containers two sliding doors operate in order to shut off all heat from the immediate part where the coal hopper is situated. Three containers can be charged and emptied at a time.

The containers are closed at the top with gas-tight lid covers or plugs. The bottom doors do not pass through the heat, and are operated to open and shut by hand levers and counter-balance weights.

It is claimed that maintenance costs will be low, since the heat which the containers have to withstand will not be above 500° C., and that at this temperature grey castings will stand a very long time.

PLANT SAFEGUARDS

By H. C. Widlake, Assoc.M.Inst.Gas E., A.M.I.E.E., A.M.I.Mech.E., of the Plymouth and Stonehouse Gas Light and Coke Company.

In January last an article entitled " Supply Safeguards " was contributed to these pages by the writer. The theme dealt with various means for ensuring the continuous and trouble-free operation of those units of plant used for sending out gas, such as boosters, compressors, and the auxiliary apparatus associated therewith.

Under the heading of " Plant Safeguards " it is now proposed to discuss in general terms means for:

(1) Protecting the works units of plant against breakdown and dislocation.
(2) Minimizing the extent of breakdown.
(3) Protecting plant operatives against personal injury.

On a modern gas manufacturing plant the various units are so interdependent that the ultimate effect of a very minor breakdown is far reaching and out of all proportion to the primary cause. It is this condition of interdependence that makes the " gadget " of yesterday the " essential " of to-day.

Generating Plant.

A discussion on the different types of generating plants available is outside the scope of this article. It is assumed that every unit of plant on the works is well chosen, of sound design, and properly installed. These factors are naturally of the utmost importance, but even collectively they are not, in themselves, sufficient to ensure satisfactory working. A great deal depends on the manner of use and the arrangements made to meet any emergency that may arise.

It often happens that the generating plant is run by attendants who have other duties under the same roof, or even outside the building in which the sets are housed. Under such conditions there is a strong case for the provision of supplementary information, distinct from that afforded by the main switchboard instruments, and available at such points as are frequented by the attendant in the performance of what may be termed his " distant " duties. This supplementary information can well take the form of a pilot voltmeter with an illuminated dial connected back to the main switchboard bus bars, together with a coloured pilot lamp connected across each feeder line running from the main switchboard to the works. The voltmeter keeps the attendant informed as to the bus bar pressure, the pilot lamps tell him that no feeder circuit has become dead due to either a blown fuse or a fallen circuit breaker.

Such an information " bureau " could be fitted very cheaply and could be provided in duplicate, or even in triplicate if the movements of the generating plant attendant led him sufficiently far afield to justify such multiplicity.

Continuity of Power Supply.—Good plant maintained under a rigid system of maintenance inspection will guarantee a supply of electrical energy reasonably free from interruptions; nevertheless, under certain conditions it is possible for irregularities to bring the supply voltage down to an embarrassingly low value. For instance, in the event of a fall of steam pressure due to heavy general load, the low pressure at the stop valves of the generating sets may very possibly be reflected in the bus bar pressure.

Again, the failure of vacuum (in the case of a condensing job) may bring the volts down due to the overloading of the engine under the suddenly imposed non-condensing conditions.

To meet this condition some discretion should be used in the grouping of the load on the various feeders. There should be some feeders which, without serious dislocation of the works processes, can be used as " load easers " should the necessity arise. For instance, boiler fans, boosters, compressors, and coke extractors should be connected to " important " feeders. Coaling plant, telphers, machine tools, &c., should be kept on other feeders and deemed unimportant loads, in the sense that they can be switched out should the need arise, so as to ease the load on the works generating plant in order to obtain control over some temporary abnormal condition which renders it impossible to carry full load. A notice somewhat on the following lines should be maintained in the engine room for the guidance of attendants:

> " In the event of its being found impossible to maintain normal voltage the following feeders may be switched out with the object of easing the load on the generators:
> No. 1 feeder ... ... coaling plant.
> No. 2 feeder ... ... works telphers.
> No. 3 feeder ... ... machine shops."

The meter fronts of the feeders concerned should be painted a distinctive colour in order to facilitate quick identification of the circuits concerned.

This instruction permits of an engine man acting immediately in an emergency with the result that essential services are kept going and supply embarrassments are confined to relatively unimportant units of plant.

When heavy loads are being handled it may not be sufficient to keep one set warmed up; it may be preferable to keep that set turning easily during that period.

Maintenance Services.

On plant running twenty-four hours a day a good maintenance service as regards both mechanical and electrical details, is the first essential if the plant as a whole is to run in a reliable and trouble-free manner. Competent mechanics and electricians used to working in harmony and possessing an intimate knowledge of the works are essential to the proper working of a heavily mechanized plant. Given the proper selection and good design of the various units of plant in the first instance, it may be observed that most serious breakdowns are caused by poor maintenance and failure to detect and rectify minor defects before they have a chance to develop. Take, for instance, an uneven joint in the track of a mono-rail telpherage. In the incipient stage the driver may feel a slight " jar," and with the constant passage of the machine over that point, he will probably fail to observe the increasing shock to the travel carriage.

Eventually it will be found that the machine has suffered serious mechanical injury, involving the need for lowering it to the ground for a costly overhaul. If the mechanic in charge of the telphers had made it a practice to take a ride around the track on each machine once a week a big repair bill would have been saved at no greater cost than that incurred by lifting one end of the track rail and inserting a shim.

It is bad practice to trust to plant operators and engine drivers to report defects, since a noise grows by such minute increments that men working all their time in the neighbourhood of the machine concerned often fail to notice anything amiss. The need is indicated for frequent and regular visits by the foreman fitter, whose ear, not being solely attuned to the note of any particular unit of plant, is more capable of detecting any undue noise.

This is particularly true in the case of machines which are characteristically noisy in operation, such, for example, as horizontal retort stoking machines. A slight looseness in a key of the travelling or stoking gear will gradually develop, un-noticed, until a definite shearing action is set up, when a new wheel or a new shaft is found to be required. Such a job often involves heavy labour charges in dismantling and re-assembling the gear, which, in themselves may be far greater than the cost of replacing the damaged parts.

Circuit Breakers.

As a protection against mechanical as well as electrical breakdowns, circuit breakers rank among the most valuable protective devices. Being purely electrical in their application they are often regarded as being solely electrical in so far as their protective capabilities are concerned, and it is not always realized that mechanical, as well as electrical, details can be protected by a well-selected circuit breaker. The appliances fall under two general headings—namely, instantaneous and time limited breakers. The instantaneous breaker opens circuit at that instant when the current flowing reaches the value at which the device is set to operate. The time limited device, as its name implies, is fitted with a time lag which delays the opening

of the circuit. In other words, the current at which the breaker is set to operate is allowed to flow for, say, two or three seconds before the breaker actually opens the circuit. The choice between the two types depends entirely upon the duty for which the breaker is required. In the case of, say, a horizontal retort stoking machine, the crane motor used on the discharging element is subjected to heavy short period overloads, so that an instantaneous breaker for this particular service would simply be a nuisance. It would trip out each time the pushing element met the caked charge and had to exert the initial pushing effort. It is in such a case that a time limited breaker set up to a two or three seconds time lag will permit of the uninterrupted working of the machine under normal conditions, without detracting from the value of the device as a protective agent in, say, the case of a very tight retort. It often happens that a charge is met which cannot be pushed out without the risk of serious damage to either the machine or the retort, and it is in such a case that the constant opening of the breaker warns the operator that he is up against some abnormal condition, and that that particular retort had better be left unpushed pending investigation. An unprotected crane motor is capable of exerting an enormous torque and a combination of old benches and an unbreakered machine may easily pile up a repair bill of hundreds a year. In the case of a retort working machine the protection provided by a well-selected breaker covers every mechanical detail, from the pusher head back to the shaft of the motor.

Incidentally, a breaker that can be tied in, held in, wedged in, or otherwise tampered with is useless for this, or, in unskilled hands, for any other purpose. The natural fool who, given the chance, is always ready to tamper with safety devices is to be found on most jobs, and the only way to circumvent him is to use appliances which do not lend themselves to delicate attentions of this kind.

Whatever the nature of the machine to be driven there is a great argument for the use of circuit breakers on all but the smallest drives, and particularly where the motor is rigidly tied to its load. Any sudden " hang up " in the driven mechanism, as in, say, the case of an elevator, a crusher, or a conveyor, results in the falling of the breaker and the consequent limitation of the damage caused.

Waste-Heat Boiler Fans.—A somewhat unusual protective function covered by the use of circuit breakers lies in their application on waste-heat boiler installations.

It is obvious that any air entering the system between the settings and the boiler inlets will increase the volume of gases being handled by the fans, with the resultant overloading and ultimate burn-out of the fan motors. Faults in the settings, inspection plugs inadvertently left out, or improperly closed dampers, can all bring about this condition. The installation of circuit breakers on the fan motors not only protects the motors against burn-out, but, by falling out under abnormal loading, give timely warning that unsuspected volumes of air are entering the system.

As regards this particular application it is advisable to keep the breakers set to open a little in advance of the normal working current and to alter the setting according to the season and the number of settings being worked through any particular boiler.

In this connection it may be observed that it pays to keep an eye on the ammeters connected in the fan circuits. Under normal conditions of working there is a fairly definite relationship between the number of settings being handled through the boiler and the current taken by the fan motor. If under normal conditions of " make " the fan motor is observed to be taking a larger current than is usual, it is a clear indication that the volume of gases being handled has increased, and a search should be made for air leakages.

Emergency Stopping Gear.

The electrical system of driving lends itself to a multiplicity of arrangements for stopping the machinery in case of emergency. It is accordingly proposed to indicate briefly the methods usually employed and to comment upon their respective characteristics.

The simplest type of emergency stopping gear takes the form of a switch connected in series with one of the main supply cables to the motor. It is definitely positive in its action but requires that the supply cable shall be diverted, en route to the motor, so as to pass through those points from which it is desired to stop the plant. In all but very small motors the switches and the extra run of mains will be expensive items and financial considerations rule this method out except in the case of small installations in which the supply mains run through or near the points from which it is desired to operate a " stop."

A system of multiple stops largely used comprises a number of normally open stop button switches so wired back to the motor starter that the closing of any switch short circuits the no volt coil and allows the starter arm to return to the " off " position. This is only applicable to a single motor and is open to the objection that a burnt contact, a weak return spring, or residual magnetism in the hold-up poles can render the system inoperative.

An alternative lies in the use of a standard circuit breaker incorporating a hold-up coil connected across the line in such a manner that the failure of current in that coil releases a plunger and causes the breaker to open. This feature can be applied to all good overload breakers so that the apparatus fulfils a dual purpose—namely, it offers ordinary overload protection and at the same time lends itself to association with a well-proved method for remote stoppage control. The required number of normally closed stop button switches are wired in series with the hold-up coil; the pressing of any of those switches de-energizes the coil and causes the breaker to fall. This method has the advantage that a broken connection in the remote stopping system brings the device into operation and draws attention to the fact that a circuit has faulted.

The systems as described above offer a means for stopping a single motor from any reasonable number of distantly situated points. A modification of the last described system permits of its being used for stopping a group of motors *en bloc*, although each motor in that group is individually free for normal use. In this case a no volt breaker is fitted in the common feeder supplying the group, the operating coil of that breaker being wired in series with the required number of normally closed push button switches. The pressing of any one button de-energizes the coil in the common breaker, causing the breaker to fall and stopping the group of motors.

This system is particularly applicable to, say, groups of retort house elevators which it may be desired, under emergency conditions, to stop from any point in the house. It may be of interest to set out the details of such an installation put in by the writer some years ago.

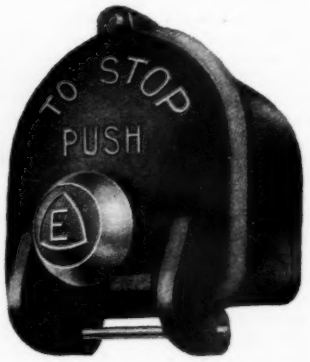


Fig. 1.

Three retort house elevators in a 280 ft. long house were used for delivering coal from the adjacent store to a push-plate conveyor running the length of the house over the machine hoppers. The plant was a somewhat old one and, being under the care of one attendant, it was desirable to stop it from any point in either the vault under the charging stage, the charging stage, or the conveyor gallery. An occasional mechanical defect in the conveyor or elevators was capable of causing considerable damage before the solitary attendant could make his way to the ordinary control points.

It was decided to install twelve equidistant stopping stations, four in the vault, four on the stage, and four in the conveyor gallery. The atmosphere being somewhat murky it was decided that each station must be clearly visible in order that no time might be lost in locating a very small push button box. Stop button boxes of the type shown in fig. 1 were installed at the positions named, and immediately over each box an ironclad lighting fitting with a red bull's-eye was provided. Six-volt lamps were used in these fittings, and the twelve stop switches, with the twelve lamps, were all wired in series with the trip coil of a no volt breaker fitted in the common supply to the four motors and shown in fig. 2. Under normal conditions all twelve switches are closed and all twelve lamps are glowing, giving a clear red indication as to the exact position of a stoppage station.

A great advantage of this system is that if an open circuit fault occurs in the wiring or the switches, or a 6-volt bulb burns out, stoppage of the plant follows as a natural result, and it cannot be re-started until the defect in the stoppage system is found and rectified.

(To be concluded.)

Southern Association of Gas Engineers & Managers

ANNUAL GENERAL MEETING

On Tuesday of last week the Annual General Meeting of the Southern Association of Gas Engineers and Managers was held at the Hotel Metropole, Northumberland Avenue, W.C. 2, under the Presidency of Mr. STEPHEN LACEY (Controller of Gas Sales of the Gas Light and Coke Company).

Prior to the business meeting luncheon was served, and a number of distinguished figures in the Industry supported Mr. Lacey in the chair. The guest of honour was Sir David Milne-Watson (Governor of the Gas Light and Coke Company), while also present was Mr. Henry Woodall (Deputy-Governor), Mr. C. Valon Bennett, representing the President of the Institution of Gas Engineers, Mr. F. G. Shaw, President of the Manchester District Association, and Mr. H. C. Sims, President of the London and Southern District Junior Association.

Mr. E. L. NICHOLAS (Vice-President), in proposing the toast of the visitors, said that they were greatly honoured by the presence of several distinguished visitors whom they were delighted to see. He coupled with it the name of Sir David Milne-Watson.

Sir DAVID MILNE-WATSON, responding to the toast, said he had great pleasure in rising to reply on behalf of the visitors—though really he was hardly a visitor there, as he was an Hon. Member of the Association. Even then he felt he was only present at a family party, for he saw so many connected with his own Company and other companies with which he had recently had something to do.

He would just touch upon two subjects. The first was in connection with the Government Gas Bill which was on its way through the House of Lords. This Bill was supposed to embody the findings of the Departmental Committee which was set up two years ago. It did not, however, embody all the recommendations of this Committee, though there were many matters which affected those in the Industry. The question had been raised, What was the Industry doing in regard to the Bill? The National Gas Council had set up a Committee to watch the progress of the Bill through Parliament, and they would do their best to make its provisions compatible with the Industry's aims.

THE DECLARATION OF WAR.

The second matter to which he would refer was a report in the Press stating that he had said that the Gas Industry had declared war on the electrical industry. They were represented, in fact, as "terrible fellows" launching the country into war between gas and electricity. This reminded him of the story of the rabbit which was described as a dangerous animal which defended itself when attacked! What he would like to stress was that war was being declared on the Gas Industry by some of the protagonists of the new electrical movement. They had seen the declaration that electricity was wiping gas off the map, and it was in view of this statement that he had said that war was being declared. But it was the electrical industry which was declaring it, and it was naturally up to gas to defend itself. The happenings of the last few months showed that the Gas Industry was not going to be driven from its field. At the recent General Meeting of the Gas Light and Coke Company he had referred to the gas lighting of streets, and he was glad to see with them on that occasion representatives of the Tottenham and District Gas Company, as they were lighting many miles of arterial road to the North.

The Industry had had a poor year, for which climatic conditions were responsible. The current year was indicating an entirely different situation and the increases recorded were very encouraging. In gas they had a splendid article to offer to the public, and if they employed up-to-date methods and saw that their customers were served in the best possible way, there would be a great future for the Industry in spite of the efforts of their friends in the electrical industry. On behalf of the guests he thanked the Association for their kind welcome on that occasion.

"THE ASSOCIATION."

Mr. C. VALON BENNETT (Senior Vice-President of the Institution of Gas Engineers) said that in the regretted absence of the President of the Institution, Mr. F. P. Tarratt, the pleasant duty fell to him of proposing the toast of the Association. He found himself in rather a peculiar position, as he was a member and Past-President of the Southern Association. This was no reason, however, why he should not have great pleasure in proposing the toast. This Association, he said, was 59 years old; but it could not be said to be hoary with age, for it was in its prime. It was one of the most live associations of its kind in the country, and was held in respect not only by its own members but by members of other associations because it was live, active, and progressive. He went on to refer to the value of the monthly discussions of their district sections, and remarked that some people thought there were too many meetings; but he considered that it would be a great blow to the Industry if the number of meetings of the Southern Association were curtailed. They were very proud to have Mr. Lacey as President of their Association, who came of a gas engineering stock known to everyone in the Industry. How well they remembered his father and the joy it gave them to listen to him. Mr. Lacey added lustre to the name he bore. Mr. Valon Bennett went on to say that he brought their new President the good wishes of the Institution of Gas Engineers; they trusted he would continue in the van of progress as he always had done, thus ensuring that this great Gas Industry, with which they were all proud to be connected, would be able to flourish in the future even more than in the past. In submitting the toast of the Southern Association, Mr. Valon Bennett coupled with it the name of Mr. Lacey, wishing him a successful year of office and trusting he would live many years to look back upon it as one of the happiest years in his life.

Mr. LACEY, in acknowledging the toast, remarked that it gave him great pleasure to take his place as President at this first gathering of their Association since his election, and to have his name coupled with the toast. Mr. Valon Bennett was particularly well qualified, he said, to speak to this toast because he knew this Association from both inside and outside—from inside as a member and Past-President he had been of most valuable service to the Association and had increased its usefulness; while as Senior Vice-President of the Institution of Gas Engineers he looked at them from outside.

Mr. Lacey went on to speak of the work of the Association, remarking that they had a long and honourable record of service to the Industry, and were conservative in the true sense. Times were not, however, what they were—and never would be—so their Association had to change with the times. The best way of realizing the change which had come over the Association was to think of the alteration in the significance of the title "Engineer and Manager." Sixty years ago the emphasis was emphatically on "Engineer;" to-day it was more on "Manager." Everyone who had the dual function of "Engineer and Manager" had to pay more attention to the management of the undertaking in these days when the management was of an extremely competitive business. A corresponding change would be found in the trend of the discussions at the meetings of their district sections, where, as Mr. Valon Bennett had said, much of the valuable work of the Association was done. These discussions were becoming more and more commercial, which was all to the good.

In conclusion, Mr. Lacey said how honoured they were by the presence of Sir David Milne-Watson and Mr. Woodall, for the health and prosperity of their Association depended on the interest taken in it by those directing the undertakings served by the various Presidents. He was therefore very grateful for the support given him by Sir David and Mr. Woodall.

BUSINESS MEETING.

When the members assembled for business after luncheon, it was first agreed that the minutes of the previous meeting, as published in the "JOURNAL," should be taken as read and confirmed, while the Annual Report for 1933, as circulated to the members, was also taken as read and approved, on the proposition of the PRESIDENT, seconded by the VICE-PRESIDENT.

NEW MEMBERS.

The following names were added to the list of ordinary members of the Association on the motion of the PRESIDENT, seconded by the VICE-PRESIDENT.

A. L. Silcox (Saltash).
H. Bradley (Gas Light and Coke Company).
R. V. Scott (Canterbury).
E. H. Greenaway (Chard).
D. L. Brown (Brighton).

Presentation to Retiring President.

The President then made a presentation to the retiring President (Mr. J. H. Cornish, of Bridgwater) of a silver salver as a memento of his year of office, remarking that Mr. Cornish was a very staunch gas man, coming from a family of gas men, and they were indebted to him for the way he had conducted their proceedings during his year of office and for the delightful day they had spent at Bridgwater. He hoped this salver would serve him as a happy recollection of his year as President of their Association.

Mr. J. H. Cornish, in acknowledging the presentation, paid tribute to the assistance he had received during his year of office from the Hon. Secretary and Committee of the Association, and also acknowledged the help of the Technical Press and the British Commercial Gas Association. He hoped Mr. Lacey would have as happy a year of office as he had.

On the proposition of Mr. J. H. Cornish, seconded by Mr. H. C. Smith (Tottenham), it was agreed that their President (Mr. Lacey) be elected representative of the Association on the Council of the Institution of Gas Engineers for the ensuing year.

Donation to Sir Arthur Duckham Memorial Fund.

The President briefly acknowledged his election, remarking that he would do his best to serve the interests of the Association on the Institution Council. Continuing, he stated that the Committee had decided to vote the sum of twenty-five guineas to the Sir Arthur Duckham Memorial Fund, and he was sure the members would approve of this. Sir Arthur had been a member of this Association, as well as being a most distinguished figure in the Gas Industry.

Presidential Address.

Mr. Lacey then proceeded to deliver his Presidential Address, which was published on p. 811 of last week's issue of the "Journal."

Mr. L. J. Langford (Tunbridge Wells), in proposing a vote of thanks to the President for his Address, said that while it was not customary to discuss the Presidential Address, he was sure he could say that what they had just heard was going to help them very considerably.

Mr. John Terrace seconded the vote, remarking that in Mr. Lacey they had the best possible man as President for the coming year. They had no doubt as to his ability; but what they felt so grateful about was that he had found time in his extremely busy life to attend to the duties of the Southern Association. They wished him the best of luck during his year of office.

The vote of thanks was carried with applause, and the President's acknowledgment concluded the business of the meeting.

Methods for Reducing District Complaints*

By A. R. Langford (of the Distribution Department, Plymouth and Stonehouse Gas Light and Coke Company).

It cannot be stressed too strongly, or too often, that since modern appliances are designed to work at a uniform pressure serious fluctuations are bound to bring dissatisfaction and complaints in their train.

At Plymouth, the maintenance of uniform pressures on our districts is greatly facilitated by the use of distant pressure indicators, installed at suitable key points. The term "key point" refers to some carefully selected point on the district at which the maintenance of a certain pressure will ensure that the district as a whole is adequately and uniformly supplied. Transmitters sited on these key points are electrically connected to the works by means of circuits leased from the G.P.O. Engineering Department at an annual rental of £8 per radial mile.

At the works end the indicators are sited under the eye of the pressure attendant, who is thereby kept informed as to the pressures prevailing on the distant points at all hours of the day and night. On the low-pressure districts, the station governors and boosters are operated according to the information transmitted by these indicators. On high-pressure districts, the transmitters are fitted on the inlets of the governors, and the works compressors are throttle-controlled to maintain a level pressure at these points.

District pressures will tend to vary as areas expand. This calls for the greatest attention and sustained contact with the trend of developments, and it is only by the compiling of records and their frequent study and comparison that the changing needs of a district can be satisfactorily catered for.

Although not strictly arising from the consideration of district complaints, I may, perhaps, be permitted to refer in passing to the subject of reinstatement of trenches along private roadways and footpaths. The matter is one which invariably calls for tactful handling. The requirements of most owners are not unreasonable, but on occasions demands are made for the re-surfacing of a far larger area than was actually disturbed, coupled with extortionate requests for future maintenance. A properly drawn up agreement, signed by both parties before work is commenced, will prevent subsequent disputes arising from this cause.

Service Governors.

Much importance is attached to these in connection with distribution, particularly where high-pressure governors or regulators are concerned.

Where groups of consumers are supplied via a service regulator, an auxiliary supply, at least, should always be available to permit of cleaning and adjusting the governor, while the fixing of an additional regulator, though involving additional expense, is usually justified on the grounds of affording a more satisfactory supply.

To cut off consumers' supplies while regulators are having attention is a policy which should never be entertained, since it not only cuts across our claim of unfailing service, but provides a weapon upon which our competitors in the electrical camp would not be slow to seize.

The total number of service regulators on our high-pressure system at Plymouth is 246, all of which are recorded on history sheets which include, among other useful information, the outlet pressures of the governors after cleaning and overhaul.

Main Cocks.

Main cocks, especially those with loose keys and no lubricating device, undoubtedly tend to contribute largely to the sum total of complaints. No lengthy reflection on the importance of main cocks, viewed as safety devices, is required to lead one to the conclusion that they are deserving of careful consideration. In our own case, a recent survey of main cocks revealed a somewhat alarming percentage of defects, but thanks to the extensive adoption of self-lubricating cocks, we are now, I am happy to say, in a much more satisfactory position. In my opinion, although somewhat higher in the first cost, the advantages of this type of cock fully justify the added expenditure.

Consumers' Meters.

As in the case of service pipes, no meter or its connections should ever be allowed to come in contact with electric cables or house wiring, defects in which may result in disastrous fires.

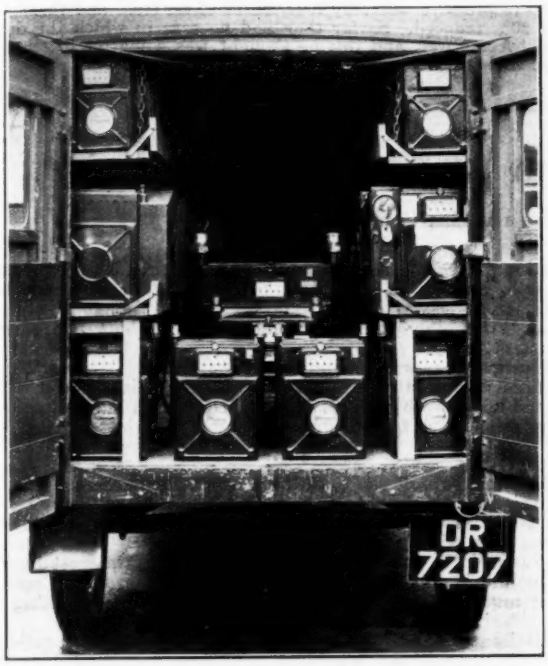
In this connection it has been found necessary to protect our fitters and our consumers' property against the consequences arising from a fault or leakage current on house electrical installations seeking a path to earth via the gas meter and service pipe. Where this condition exists, a spark can occur when disconnecting a meter, with the resultant ignition of gas or the possibility of a dangerous shock to the fitter who is, naturally, quite unaware of any electrical defect on the premises. It is quite possible, under such conditions, for a dangerous potential difference to build up between the disconnected meter and the adjacent service pipe.

Each fitter is provided with a 6-ft. length of light cable fitted at each end with a crocodile clip for the purpose of "bridging" the meter and its connections before disconnecting. This procedure ensures that continuity to each is maintained, and that no spark or potential difference can arise following disconnection of an inlet or outlet pipe.

Much valuable time is often lost in the changing or removal of meters due to the fitter having to walk to and

* From a paper before the Western Junior Gas Association, Plymouth, March 10, 1934.

from the job—a state of affairs which does nothing to mollify an impatient consumer. Our own observations have shown 40 minutes to be an average walking time for a single change in the City area, and some 140 minutes on the outlying districts. Such times are wholly disproportionate to the time required for the completion of the actual job, and in addition to inconveniencing the consumer they involve the gas undertaking in heavy and avoidable expense, particularly in the case of a large concern where the meters dealt with can be counted in thousands annually. In addition to lost walking time, the aggregate of fares by 'bus or tram reaches no mean figure in the course of twelve months.



Interior View of a Meter Van of the Plymouth and Stonehouse Gas Company.

These several considerations have led us to provide a meters van. Its introduction has gone far to reduce to a minimum the walking time of our fitters when changing meters. The van is capable of accommodating some 40 to 45 domestic meters on folding shelves, the lower of which can readily be converted into seats when conveying workmen on the district. The vehicle is handled by two "fitter-drivers" who now attend to practically the whole of the meter changing, both ordinary and prepayment.

Before leaving the subject I refer to a device which we are trying out with the object of preventing the deposit of corrosive matter in the interior of meters with its consequent wear and tear on the working parts. A tapered screen, secured to a brass ring, is inserted in the inlet pipe. A small hook enables it to be readily withdrawn for cleaning when necessary.

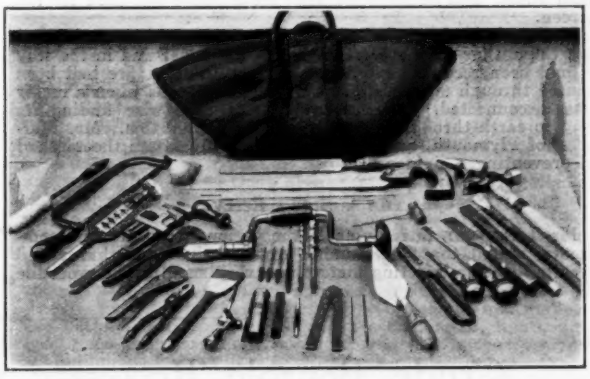
Personnel.

The efforts of the finest inspector may fail to secure satisfactory results where the fitters actually carrying out the work under his direction are not fully qualified in gas fitting and plumbing, and possessed of adequate technical knowledge.

Men with such qualifications are, admittedly, not readily obtained through the media of the Labour Bureaux or other similar channels, but here gas undertakings can at least work out their own salvation by training fitters themselves. At Plymouth we have followed this course for the past 20 years, and at the present time have 25 boys undergoing training as gasfitter apprentices.

The boys are given every opportunity and encouragement to become highly skilled fitters, and there is a grading system after the age of 19 years whereby a higher rate of pay is awarded to apprentices gaining prizes and certificates for practical and technical work.

The apprentices in the higher grades are entrusted to execute some of the simple and more straightforward jobs on their own, which not only develops confidence and self-reliance, but affords valuable guidance in the selection of those apprentices to be retained, more or less permanently, upon completion of their indentures.



Kit of Tools Supplied by the Plymouth and Stonehouse Gas Company to Apprentices at the age of 19 and paid for weekly.

The most highly-skilled workman cannot give the best account of himself if he is handicapped by inadequate or inferior tools. Bearing this in mind, it is our practice to provide each apprentice with a complete kit, for which he commences to pay immediately he is out of his time. The kit provided is illustrated in the accompanying photograph.

Service to the Consumer.

Our slogan at Plymouth is—"Modern Gas at Moderate Price with Modern Service."

In the spirit of this slogan, in addition to the normal emergency fitters and complaints staff, we have established a fleet of light "service vans" for the rapid transport of men and materials. Three outstanding advantages attached to the use of these vehicles are:

(1) The conveyance of fitters to their allotted districts allows more work to be completed per man, while the consumer enjoys a more expeditious service.
(2) There is an economy of much walking time in the outlying districts, together with the saving of fares in public conveyances.
(3) The "fitter-drivers" are able not only to carry out the necessary work, but also to issue replacements to consumers, such as burners, brackets, mantles, globes, &c.

There is ample evidence that this additional service is appreciated by our consumers, particularly those in our outlying districts, while the vans themselves advertise the prompt and progressive methods of the undertaking.

It is of interest to note that since the inception of this service, some 16 months ago, the cost of running these vehicles has been more than covered by the saving in fitters' wages, 'bus and tram fares, and walking time.

As a parting suggestion for the reduction of district complaints, I would advocate the purchase and fitting only of such gas appliances as are of really sound construction, modern design, and proved economy of gas consumption.

Discussion.

The President (Mr. S. Hole) expressed interest in the scheme for the use of a fleet of light vans to reduce the walking time of fitters. He thought Plymouth was in a similar position to Bath in that, owing to the hilly nature of the district, although cycles might be provided, little riding was done. The author's work with the dust arrestors would also prove valuable. He asked in what proportion of houses electric current had been found when disconnecting meters.

Mr. F. G. O'Niell (Bristol) mentioned a case in which he had received a severe electric shock when handling apparatus in a certain house as a result of a wireless set run off the mains.

Mr. A. C. Shilson (Weston-super-Mare) asked what name was given to the gauze dust filter and whether a plate screen had been tried to intercept dust. He also asked the difference in cost of ordinary service cocks and the self-lubricating type.

Mr. Denton (Torquay) inquired whether the felt dust arrestor would require a special box to house it. He also thought that if the dust became wet in the gauze filter, it would offer excessive resistance to the flow of gas.

Mr. D. L. Copp (Exeter) asked if Mr. Langford would tell him the direction of gas flow through the felt filter, and explain how removal of the dust was dealt with.

Mr. Sullivan (Plymouth) mentioned that the benefits of putting district governors above ground could not be too strongly emphasized, and illustrated this with a case he had encountered before going to Plymouth.

Mr. A. Barrett (Frome) asked if any information was avail-

able as to the fall in pressure through a meter with and without the gauze dust filter.

Mr. A. MARSDEN (Bristol) said he thought excessive pressure might arise through the dust particles in the filter being wetted with gums, and he inquired what mesh gauze was used for the screen.

Mr. R. J. H. CLARK (Engineer, Plymouth), after complimenting the author on the presentation of the paper and in the way it had been received, referred to a case where a fire had been caused through an electric spark igniting the gas when a meter was disconnected. The current from a bare wire finding its way to earth through a gas service had caused this. Mr. Widlake, of Plymouth, had demonstrated to the fitters the method of preventing a similar fire.

THE AUTHOR'S REPLY.

Mr. LANGFORD, in replying to the various questions and comments, stated that the number of cases in which harm had resulted in disconnecting meters was very small. The crocodile clips had been used as an insurance, as the danger was certainly likely to be encountered. There was no special name for the gauze screen. Mr. Langford stated that he had not tried a perforated plate screen, but did not think it would be so easily fixed as the type now in use. Self-lubricating cocks were about a shilling a dozen more than the ordinary cocks of the same size. The large felt dust arrestor required a special box into which it was fitted, and the gas passed from the outside to the interior of the felt, then on through the main. In changing the felt a spare was taken by the fitter which was inserted. The dirty filter was returned to the works for cleaning to obviate any complaint of leaving the dust about the streets. Experiments had been carried out with the small type filter, and it had been observed that when the filter was clean there was no appreciable pressure drop through a meter fitted with one and with the filter out. Even when the screen was full of dust the drop in pressure was only four-tenths of an inch, and throughout 20% reduced. So far they had no case in which the dust had become wet, and this he thought was a matter of service pipe fitting. No gum trouble had been experienced.

Crude Benzole Recovery from Vertical Retort Gas*

By H. J. REYNOLDS, Wolverhampton Gas Company.

The wash oil process was, and is, the most economical method for benzole extraction, and in May, 1917, we commenced working at Wolverhampton a plant installed by the Chemical Engineering and Wilton's Patent Furnace Company, Ltd.

The plant was erected for the production of crude benzole of 65% quality—that is, 65% distills over up to 120° C. from a 250 c.c. retort with the bulb of the thermometer $\frac{3}{8}$ in. from the bottom of the retort.

This test is an unreliable one and I think the one devised by the Department of Explosives Supply of much more value. 200 c.c. of the crude benzole is distilled from a round-bottomed flask through a 12 pear Young's fractionating column to a condenser. The speed of distillation is regulated to one drop per second, and the bulb of the thermometer is fixed slightly below the vapour outlet of the column.

In 1917, the gas being washed was from inclined retorts, and no difficulty was found in producing a ready salable spirit of 65% quality.

Gas oil was not used as the washing medium at the commencement of 1917-18 period, a much heavier oil, green oil, being utilized. This brought no end of trouble after a while, as it thickened badly and finally had to be exchanged for gas oil, which is a very satisfactory and convenient oil for use. The recovery while stripping all inclined retort gas was 2 gallons per ton of coal (total stripping was not attempted) the specific gravity of the crude benzole being 0·850.

From 1917 to 1929 we recovered some 530,000 gallons of crude benzole. In 1929 the benzole recovery plant was shut down because under the conditions then existing benzole recovery was not a paying proposition. Recently, however, the recovery of benzole from town gas has again come to the fore.

New and more economical plants have been devised to enable the recovery of the spirit at the minimum of expense and numerous benzole recovery plants have been installed throughout the country during the last two years. The works installing these plants have been mostly those making horizontal retort gas or mixing vertical and horizontal gas. The question of scrubbing vertical retort gas is apparently a less attractive proposition, but nevertheless it demanded consideration.

In 1932, when the prices obtained for the spirit were such as to make benzole recovery a paying proposition, we decided to give our rather antiquated plant an experimental run. A start was made on Jan. 27, 1933, by washing the stream of gas from one of the Woodall-Duckham vertical retort installations (C.V. 450 B.Th.U.). The experiments at Wolverhampton upon benzole extraction from vertical retort gas should prove, I think, of value and interest to the Gas Industry.

The extraction proved very satisfactory except for the fact that the crude benzole recovered was of a very low specific gravity, 0·818. (I have since heard of other undertakings stripping all vertical gas with modern plant whose product gives 0·835 specific gravity, no doubt due to different coals being carbonized.) The 0·818 specific gravity is due to the high percentage of paraffins (45%) in the crude benzole recovered. Some difficulty was experienced in disposing of this product, as the specific gravity of our product when rectified was only 0·820, whereas it must be between 0·870 and 0·885 to conform to the specification of the National Benzole Association. This specific gravity is, of course, impossible with 45% of paraffins in the benzole, but Mr. S. E. Whitehead, in his book "Benzol," states that "the high paraffin content in motor spirit is of no moment."

However, market conditions for crude benzole have altered somewhat, and I can safely say it is now possible to sell at profitable prices crude benzole from vertical retort gas irrespective of specific gravity.

COST OF RECOVERY.

Before I submit the following costs of benzole recovery, I must admit they are high. We must bear in mind that the plant is an old one; consequently recovery costs a little more than with modern equipment.

Basis No. 1.—As plant is paid for, no capital cost figure is included, only depreciation to keep it in order. Capital cost must, of course, be included when an undertaking is considering new plant.

Estimating the make of crude benzole as 61,320 gallons per annum, the gross cost of obtaining 1 gallon of crude benzole = 7$\frac{7}{8}$d. This is made up as follows:

	d.
(*a*) Value of benzole in gas at inlet to holder replaced by 1·6 therms per gallon at 3·85d. per therm	= 6·16
(*b*) Cost of plant, &c., paid, depreciation on £600 at 10%, suggested allowance for maintenance	= 0·30
(*c*) Steam	= 1·00
(*d*) Water	= 0·10
(*e*) Oil (replacement of loss)	= 0·20
Gross cost	= 7·76

Basis No. 2—	d.
Gross cost per gallon of benzole	= 8·56
(*a*) Gross cost Basis No. 1	= 7·76
(*b*) Labour and supervision	= 0·80
	= 8·56

Data on which costs were based—

1. Fourteen 7-ton Woodall-Duckham vertical retorts (6-ton throughput) = 30,660 tons per annum
2. Make of benzole (2 gallons per ton of coal) = 61,320 gallons
3. 1 gallon of benzole represents 1·6 therms taken from the gas = 1·6 × price of gas per therm at inlet to holder
   = 1·6 × 3·85d. = 6·16d. per gallon

NOTE.—Mr. C. Cooper ("The Case for Benzole Recovery," "JOURNAL" for May 13, 1931) claims a much lower figure here on grounds of no distribution or storage charges, and also claims a reduction in price per therm by a proportion of carbonizing, washing, and purification charges. His figure is as low as 3·6d. per gallon of benzole for this item.

With regard to purification there is a possible detrimental effect of oil fog on oxide. This favours, to my mind, the inclusion of the maximum value figure, 6·16d. per gallon, as above.

4. *Depreciation on Plant, Pumps, &c.*—Figure of £600 worked on.
5. *Steam.*—Cost per 1,000 lbs. is 1s. 1d. (maximum). Estimated consumption on benzole plant, 78 lbs. per gallon of benzole recovered.
   NOTE.—Again we get an exceptionally high figure on account of old-fashioned plant. Under modern conditions the steam per gallon of benzole is more like 35 lbs.
6. *Oil Loss.*—On three months' working the loss was 300 gallons. Estimated total loss per annum = 2,000 gallons (maximum). Oil at 4$\frac{3}{4}$d. per gallon.

Even from these absolute maximum figures you will see that there is no doubt about benzole recovery being a

* From a paper before the Midland Junior Gas Association, Birmingham, March 8, 1934.

paying proposition when a selling price of, say, over 10d. per gallon, can be obtained for the spirit recovered. The selling price is certainly much higher than that usually.

Naphthalene.

As we know, naphthalene deposits with vertical retorts are absent. However, what small quantity there is in the gas is removed by the washing for benzole, and most of it distils from the oil and remains in the crude benzole.

Gum or resin forming bodies in town gas, principally oxidizable heavy unsaturated hydrocarbons, are removed also by the benzole stripping operation.

Summary.

To summarize the main points I wish to emphasize in presenting this paper:

1. Benzole recovery from coal gas is a sound paying proposition, whether from horizontal, inclined, or vertical retort gas.
2. It is our national duty to recover benzole; there is a shortage of it, and the demand is great.
3. Benzole recovery helps to solve the unemployment problem in the coalfields.
4. Every gallon recovered brings us nearer to national independence and adds to the country's security in times of emergency.

Discussion.

The President (Mr. S. K. Hawthorn) expressed the indebtedness of the Association to Mr. Reynolds. Most gas engineers thought benzole extraction from horizontal gas was a paying proposition if the declared value was not higher than 525. There was a difference of opinion as to continuous verticals, and he did not think anyone could say benzole recovery from continuous verticals did, or not did, pay in all circumstances. The main factors were the coals available and—more important still—the declared calorific value. It was difficult to determine what it cost to extract the benzole therms from gas, because the therms had to be replaced in some way.

Mr. J. H. Gee proposed a vote of thanks to Mr. Reynolds. He thought they were right in sounding a note of warning as to any generalization on the advisability of washing vertical gas for benzole. Then there was extra coke to be got rid of. That was all right if they had an expanding coke market, but if the availability of that extra coke was likely to have any effect on the price, then any profit built up might be greatly reduced. A drop of 5s. or 10s. might easily wipe out 2d. or 3d. a gallon on benzole. The national aspect could not be overlooked.

Mr. H. S. Adams (Bilston), who seconded, referred to the question of testing. This had been a sore point with him, and he agreed with Mr. Reynolds about the retort test. That test was definitely unfair to benzole made in a gas-works. The test on which they sold their benzole was the second one, which was much fairer. In marketing benzole it was up to those who were not members of the National Benzole Company to ascertain what was happening to the benzole before they made any contracts, because there were people who would buy the benzole and mix it with petrol and put it on the market, and that would get benzole a bad name. They knew theirs was being rectified and went into motor spirit, but it went in in the proper form. He agreed with Mr. Reynolds when he said the cost of production figures were high. They thought it cost them about 5d. per gallon, and that included the extra coal which one had to carbonize. He appreciated the importance of the national aspect. He believed the demand in this country was 1,000 million gallons per year and the output was only 30 million gallons so it was up to the undertakings to go in for this plant. Undoubtedly it did pay. He thought there was a much greater profit to be obtained than Mr. Gee mentioned.

Mr. Norman Wilton, of the Chemical Engineering and Wilton Patent Furnace Company, Ltd., pointed to the disadvantages which the Wolverhampton engineers had to contend with; and yet they made a profit. In view of these considerations and the national aspect, those who were doubtful ought to take heart and go in for plant. There could not be a better way of dealing with coal than in a gas-works, provided the gas-works recovered these products and made it clear that, by using gas, people were enabling these products to be recovered and were doing work of national importance.

Mr. Robinson (Midland Tar Distillers) said the question of test seemed to be a thorny one. He thought, however, they could see better times ahead. The National Benzole Company were dealing with the matter and they had probably got further than many people realized. They had been working for some time to produce a method of test and assessment which was fair.

Mr. Taylor emphasized the importance of seeing that crude benzole was not sold as the finished product.

Experiences with High-Pressure Gas for Road Transport*

By F. B. Halliwell, of Rotherham.

In November, 1932, following investigations on the Continent, the Rotherham Corporation Gas Department installed a Belliss & Morcom four-stage gas compressor having a capacity of 10 c.ft. per minute.

A 30-cwt. general purpose van was converted to run on town gas. The engine, a 24-h.p. Halley, having a compression ratio of 4·45 to 1, was four years old when converted and had an average mileage of 9·8 per gallon of petrol. No alterations were made to the engine, nor was it overhauled before the changeover. It will therefore be appreciated that the figures to be given later are representative of the results obtainable under everyday conditions.

Early Difficulties.

Most new ventures have their attendant difficulties, and ours was no exception. First, it was found that back-firing in the silencer of the engine occurred when running down an incline or when the accelerator pedal was quickly released. Figures of gas consumption per mile were taken and found to be 35 c.ft., which was considerably in excess of the estimated figure. To counteract back-firing, long-reach plugs (reach 1 in.) and having a gap of 0·018 in. were fitted. On trial a slight improvement in smooth running was observed, but against this there was a considerable loss of power.

A new orifice plate having a $\frac{1}{2}$ in. hole was fitted in the air-gas mixer in place of the existing $\frac{5}{8}$ in. orifice plate. This had the effect of improving general performance and also reduced the gas consumption per mile to approximately 32 c.ft., but back-firing in the mixer occurred when climbing steeply.

Attention was then drawn to the pressure-reducing valve, for it was realized that only slight improvements could be made by experimenting with the mixer and special plugs. The reducing valve reduces the pressure from 3,000 lbs. to −4/10 in. W.G. in two stages. The first stage is a cylinder containing a piston supported by a strong helical spring, while the second stage takes the form of a diaphragm governor. Gas at high pressure enters the first stage and is reduced automatically to 3 lbs. per sq. in. gauge.

The governor consists of a leather diaphragm which carries an adjustable spindle at its centre. Due to suction from the engine the diaphragm is drawn inwards, and the spindle in the centre of the diaphragm makes contact with a ball valve which is situated on the outlet of the first stage.

The ball valve is opened and gas flows into the space between the casing and diaphragm and to the mixer. When the gas pressure overcomes the atmospheric pressure the diaphragm is pushed outwards and the ball valve is allowed to seat. Thus it will be seen that, if the length of the spindle is reduced the suction must be increased to open the valve; whereas if the spindle is too long the valve is open continuously and an excess of gas passes to the mixer. Working on these lines, various positions of the spindle were tried and the best position was found.

The original sparking plugs were substituted for the 1 in. reach plugs and a $\frac{7}{16}$ in. orifice plate was fitted in the mixer, with the result that the engine responded well under all conditions.

In addition, the gas consumption was reduced to 27 c.ft. per mile, which was very satisfactory.

During the past year a distance of 9,130 miles has been covered by the van and the total gas used was 298,400 c.ft. The circumference of operation of the van is approximately 42 miles per charge, varying with the nature of the country, and the storage cylinders are charged twice per day.

Analyses of the exhaust gases from the engine were taken with the engine running free, and with various throttle openings the following results were obtained:

—	CO_2.	O_2.	CO.	Excess Air.
	%	%	%	%
Ticking over . . .	6·85	6·75	0·24	54·8
¼ throttle	7·59	5·07	0·18	41·99
½ ,, ...	8·22	3·79	0·10	33·06
Full ,, ...	8·48	2·75	1·63	11·09

* Paper before the Yorkshire Junior Gas Association, Batley, March 24, 1934.

Compressing Plant.

With regard to the compressing plant, the only trouble experienced was due to emulsified gums and sticking of valves on the main storage bottles.

The formation of the deposits in the compressor caused a great decrease in output and seriously affected the working of the compressor valves. Although the gas was filtered (before passing to the compressor) the deposits formed in the inlet pipe between the filter and the compressor, and were thus carried through the various stages.

A sample of the deposit was sent to Dr. C. M. Walter, Engineer-in-Charge of the Birmingham Industrial Gas Research Laboratories, for his inspection. On analysis the deposit proved to be emulsified gums.

On the makers' suggestion, drain cocks were fitted on the underside of the inlet pipe, and, after every run, these cocks are opened to drain any oil or deposit which may have accumulated.

This has completely cured the trouble, and the compressor has now been running many months without decrease of output.

All gas entering the compressor is metered, and whereas it was thought that the pulsations might have a deleterious effect on the meter this has not been the case. By metering the gas compressed some idea of the percentage loss due to compression may be obtained. The losses may be allocated as follows:

(1) Pipeline losses after compression.
(2) Pipeline losses after charging the van.
(3) Cleaning storage bottle valves.

The investigations in this direction are not yet completed, so that nothing can be said as to the magnitude of these losses.

To overcome the difficulty due to sticking of the valves on the gas storage cylinders, these are taken out alternately (there are only two) every two months. Before removing the valve the pressure is reduced to approximately 700 lbs. per sq. in. by charging the van, and the remainder is blown to atmosphere.

This involves a loss of approximately 238 c.ft. per month, which is a small item when compared with the total volume of gas compressed.

Running Costs.

In regard to the running costs of the van, during the year the price of petrol has varied from 13·873d. per gallon to 11·35d. and back to 12·374d., while the price of gas—charged against the van—remained constant at 2s. per 1,000 c.ft.

For the last few months the gas consumption has been approximately 27·5 c.ft. per mile, and the relative costs are:

Gas at 2s. per 1,000 c.ft.	=	0·653d. per mile
Petrol at 12·374d. per gall. . . .	=	1·258d. ,,

Gas is thus equivalent to petrol at 6·423d. per gallon.

The total cost of fitting the experimental van with gas was £110 9s. 10d.

The Ministry of Transport at present allows the gas equipment only 5 years' life, so that the annual charges are £27 4s. 4d., and in addition there is £5 increased tax on a 30-cwt. van running on town gas.

The normal mileage per annum for this van is approximately 10,008 miles.

The balance-sheet for the experimental van is thus:

$\frac{10{,}008 \text{ miles}}{9{\cdot}8 \text{ m.p.g.}} \times 6{\cdot}5\text{d.}$			=	£27 13 1
Annual charges on equipment . .	£27	4 4		
Increased tax	5	0 0		
			32	4 4
Loss on year			£4	11 3

It would thus seem that before a profit can be made the equivalent petrol consumption of the van must be greater than 1,200 gallons.

With regard to compression costs, it has been impossible to assess these accurately due to the fact that the steam for the compressing plant is supplied by a works boiler which is always under easy steam for gas-works purposes, and the attendants are regular shift men.

Figures supplied from other sources indicate that, under reasonable load conditions—say, 8 hours per day—the cost should be about 1s. to 1s. 2d. per 1,000 c.ft. of gas compressed.

The following conclusions have been fully borne out during the past year:

(1) That an ordinary petrol driven vehicle may be converted to run on gas without the necessity for elaborate alterations.
(2) The results obtained with such a vehicle are particularly good from the point of view of both reliability and fuel economy.
(3) That correct adjustment of the reducing valve is of primary importance.
(4) The special sparking plugs do not affect the fuel consumption to any large extent.
(5) A gas propelled vehicle has great ease of starting even under adverse conditions, and may be depended upon to give high performance under all conditions of working.

High-Pressure Distribution*

By H. Firth and H. Ramsden, of Halifax.

High-pressure gas as applied at Halifax is utilized for street and shop window lighting; boosting low-pressure mains; and supplying outlying districts. Two distinct high-pressure mains leave the works. The first is a 4-in. Mannesmann steel tube extending 5 miles for the supply to Hipperholme, Lightcliffe, and Bailiffe Bridge Districts, to reinforce the supply in the low-lying parts of this area, and for transmission to a bulk supply consumer at the extreme end of the line. The output to this main is controlled at the works by a 4-in. high outlet pressure governor set, in duplicate, which is loaded to maintain a district pressure of 4 lbs. per sq. in.

High Outlet Pressure Governor.

The primary governor is constructed to withstand very high pressure. It breaks down the high inlet pressure to reasonable limits (usually 1 lb. per sq. in. in excess of the desired outlet pressure) and prevents the inlet pressure oscillation, due to compressor action, affecting the secondary governor. To attain these results the primary governor has twin valves, of the leather seated type, which neutralize the effect of the pressure oscillation and provide a constant outlet pressure.

The secondary governor being thus supplied with a constant inlet pressure of, in our case, 5 lbs. per sq. in., has only one valve, which again is leather faced and closes against a knife-edge seat. Originally these two main governors were spring loaded, but it was found beneficial, in our case, to install dead weight loading on the secondary section. In order to prevent banking of pressure or oscillation of the governor valve during periods of low consumption, an auxiliary system is fitted to the secondary governor. The inlet to the ½ in. auxiliary governor is controlled by a needle valve taken from the intermediate space between the two main governors, and consists of ½ in. wrought-iron tube. The outlet from the auxiliary extends to the outlet main and so enables small quantities of gas, at a controlled pressure, to pass to the district when the secondary governor is closed. The valve spindle in the secondary governor extends below the valve to an additional diaphragm in the base of the governor, the underside of which is in communication with the outlet of the needle valve.

Action of the Governor.—Consider a period of low consumption. The main secondary governor is closed and the district is being fed through the auxiliary governor. As the consumption increases, a point is reached at which the auxiliary cannot maintain the required outlet pressure. At this point the inlet pressure to the auxiliary falls, due to the restriction of the needle valve, giving a reduction of the upward thrust on the bottom diaphragm of the secondary governor and so allowing this governor to take the load.

Maintenance.—The sets are worked alternately over periods of one month, each governor as it is taken off being thoroughly inspected and oiled. It is usual to overhaul the auxiliary system each month, but a complete overhaul of the whole set is only necessary twice each year. The performance of each set is checked by means of roll type pressure registers which give permanent records of the outlet pressure and so enable any slight defect to be instantly traced and remedied.

At the district end of the steel main are fixed 4-in. governors, again in duplicate, which reduce the pressure to 35/tenths water gauge, previous to being metered. Considerable trouble has been encountered with this type, installed in 1913-14, due to the fact that the inlet valves are

* From a paper before the Yorkshire Junior Gas Association, Batley, March 24, 1934.

inaccessible, and it is not proposed to offer a description of an apparatus which is shortly to be replaced.

At a point 4 miles from the works it has been found necessary to install twin 4-in. governors, by means of which the existing low-pressure main, which terminates at this point, is boosted, at periods of peak load, in order to maintain a minimum pressure of 30/tenths water gauge. To facilitate maintenance the valves and seats are removable intact and with a minimum of trouble. The joints between valve cage and governor body are ground to fit and are held gas-tight by means of four $\frac{5}{16}$-in. round head set screws. These governors are worked in monthly rotation; the stand-by governor being kept in perfect working condition and ready for use in case of emergency, while each dust trap is cleared approximately four times a year.

An additional branch from the high-pressure main feeds, through a high-pressure governor, a farm, a laundry, and a group of houses, all of which are situate at the bottom of a valley.

The pressure drop on the steel main is considerable during load periods. The minimum pressure recorded at the district end of this main is 1·25 lbs. per sq. in., which gives a consumption of 6,354 c.ft. per hour. The 1,000-light wet meter, through which gas is sold in bulk as aforementioned, registers, at peak load, an hourly consumption of 4,200 c.ft., thus leaving approximately 2,000 c.ft. per hour passing through the boosting governors.

The Luddenden District.

The second main supplies the village of Luddenden, which is situated $4\frac{1}{2}$ miles from the works. This main is of 6-in. Mannesmann steel tube for a distance of $1\frac{1}{2}$ miles, where a high outlet pressure governor is fixed and where the main is reduced to 4 in., to continue the further 3 miles to the terminal governor at Luddenden.

In this case the output at the works is controlled by means of twin 6-in. governors, loaded to a pressure of 4 lbs. per sq. in. and exactly similar in type to the 4-in. sets on the section previously described.

The high-pressure governor fixed at the inlet to the 4-in. main is of the counterbalance type similar in construction to the low-pressure governors used in the boosting lines of the other section. The function of this governor is to reduce the pressure in the 4-in. main to 2·5 lbs. per sq. in., which has been found ample for the demands made by this district.

At the terminal point on this main is fixed a 4-in. governor, loaded to give a pressure of 35/tenths water gauge in the low-pressure systems supplying the 89 consumers at Luddenden. This governor is not in duplicate, and therefore necessitates the use of a 2-in. high-pressure service governor to by-pass the main governor during its overhaul, which must be carried out during periods of low load.

Groups of cottages, farms, &c., are fed by means of high-pressure service governors. In all there are 10 trunk service governors, each of which supplies a row of cottages, and 106 smaller service governors supplying separate consumers. The former are all fixed in pits in the roadway, and the latter directly at the inlet to the consumer's meter. All these governors are fitted with leather-seated valves, and have given extremely good service under all conditions of use. The trunk governors are inspected each week and oiled as necessary, while the pits are cleaned out at each visit in order to prevent the accumulation of dirt and refuse. The house service governors are inspected and oiled every six months, since their less exposed position overcomes the necessity of very frequent attention.

At the point of highest altitude along the Luddenden main a 4-in. branch feeds the village of Wainstalls through a low outlet pressure governor, similar in construction to the boosting type already mentioned. A 4-in. low-pressure cast-iron main extends from the governor to the village, where 123 consumers are supplied. Due to altitude losses it is necessary to have an outlet pressure at the governor of 65/tenths water gauge to provide an adequate pressure in the village.

Along the major portion of the high-pressure main, street lamps are fixed and are supplied through small high-pressure governors, which are fixed on the riser immediately prior to the clock controller. Here, again, very little maintenance is found necessary, and only amounts to the application of oil to the governor at yearly intervals.

The high-pressure lighting is confined to the town centre, where lamp maintenance is carried out by a special staff of men whose duty also includes the lighting and extinguishing of these lamps. Here the system of mains is necessarily complex, but an unvarying pressure is easily maintained by means of spring-loaded high-pressure governors which are fed from the 6-in. steel main supplying the main district of Luddenden. The installation of dual feeder mains to this ring system facilitates the maintenance of an unbroken supply during such time as either of these governors may be shut off for overhaul.

The Compressing Plant.

The ideal point from which gas should be taken for a high-pressure supply is immediately after the holder outlet valve. This was impracticable at Halifax, and the inlet main to the compressors is taken from a 24-in. district main near the compressor. Owing to the fact that consumers are supplied almost adjacent to this connection, it was found necessary to counteract the effect of the varying pull of the compressor by installing an anti-fluctuator. Difficulty was experienced due to oscillation of the valves of the apparatus in response to the compressor action, which thus gave a fluctuating pressure in the district main. This was rectified by means of a dash pot incorporating a piston which is fixed to the base of the valve spindle of the anti-fluctuator.

A dual compressing plant is essential to ensure a continuous supply of gas under all conditions and to facilitate the overhaul of each compressor as required. Both compressing sets at Halifax are steam driven, and consist of a rotary and a reciprocating set.

The rotary set consists of two rotary compressors of the two-blade, block driven type, having a total capacity of 30,000 c.ft. per hour at 200 r.p.m. against an outlet pressure of 5 lbs. per sq. in.

The reciprocating set is a single-stage compressor, working on the pump principle, capable of dealing with 30,000 c.ft. per hour at 310 r.p.m. against a pressure of 20 lbs. per sq. in.

Two converted Lancashire boilers, each 30 ft. in length and 8 ft. in diameter, having a total capacity of 7,120 c.ft. of gas under a pressure of 20 lbs. per sq. in., are fixed in the open, in close proximity to the compressor house. The gas from the compressors passes direct to these receivers, where cooling is effected, causing a considerable amount of condensate to be deposited. An overhead pipeline carries the gas from this point to the governors and so promotes further cooling of the gas stream.

The high-pressure system at Halifax has made gas available in otherwise inaccessible districts, and incidentally has improved the supplies in the erstwhile low-pressure areas of one of the hilliest, if not *the* hilliest, gas supply area in the British Isles. The Pennine Chain passes through the Borough, and presents innumerable difficulties which have been overcome by the use of the high-pressure system.

Gas Companies' Results in 1933.

Broadstairs (S.E. Gas Corporation).

The capital account of the Broadstairs Gas Company shows that there has been an expenditure of £1,419 on new meters and mains during the last year, this being an increase of £546 over the previous year. Against this expenditure, £1,410 has been written off for depreciation and £1,000 transferred from the capital redemption fund on account of old works and plant. The debit balance of the account has therefore been reduced to £1,805. The sales of gas show an increase of 7,500 therms, or nearly 1¼%. This brings in an increased revenue of £413, and corresponding to this is an increase of £364 from the sales of coke and other residuals. There is a general reduction of expenditure to be noted in the revenue account. Coal cost £160 less, and there was a saving on repair of works and plant of £400. A sum of £1,000 has been transferred to the capital redemption fund this year, an item which was passed over in 1932; and the amount transferred to the renewal fund has been increased from £250 to £1,000. The balance carried to the credit of the profit and loss account is £7,610, and after the payment of certain standing and other charges there is a sum of £3,791 from which to pay dividends. The Directors therefore recommended the payment of a dividend of £4 0s. 6d.% on the 7% standard consolidated stock and £2 10s.% on the 5% preference stock for the December half-year, less income-tax in both cases. This absorbs £2,542, leaving £1,348 to be carried forward to the credit of the current year. During the year 145 new services were connected, while the number of appliances fitted includes 185 cookers, 109 fires, 66 water heaters, and 30 coppers.

Corbridge.

The Corbridge-on-Tyne Gas Company showed a slight increase in the sale of gas but a considerable increase in the demand for gas appliances. The accounts showed a gross profit of £1,099, and a dividend of 6%, less income-tax, was approved.

Hassocks.

The Hassocks and District Gas Company show considerable economies in the working of the concern, and the leakage account was remarkably low. During the year extensive repairs had been carried out to the larger gasholder at Hassocks Works, and further improvements had been made in the distribution system at Henfield. The accounts and balance-sheet were adopted at the annual meeting, and a dividend at the rate of 7% per annum, less income-tax, was declared.

GAS MARKETS & MANUFACTURES

Stock Market Report.

[For Stock and Share List, see later page.]

Despite the eve of the Easter Holidays, business on the Stock Exchange last week was good, the activity in most sections being sustained right up to the close on Thursday. There was a heavy demand for British and Colonial Government stocks, and the interest in industrials was well maintained. Home rails are steadily recovering from the set-back of a few weeks ago, and the market appears in a mood to respond to any further improvements in traffic returns.

Gas stocks and shares continued to be well supported, and prices generally displayed a firm tendency, though with few exceptions quotations remained unchanged. Croydon sliding-scale and Imperial Continental both rose 1 to 155½ and 208½ respectively, while a few debentures hardened, including South Metropolitan 3% by 2 and Commercial 3% by 1, both stocks now standing at 85½. On the other hand, South Metropolitan ordinary dropped 1 to 131½, and Cape Town £10 shares a fraction to 5.

In view of the electricity complex which still persists in many quarters, it may be well to point out that the popularity of gas stocks with the investing public shows no signs of abating. On the contrary, the demand is such that values are still gaining ground, a fact clearly shown in the following table of current prices of ordinary stocks compared with those ruling a year ago:

—	Quotations.		Increase.
	April 1, 1933.	March 29, 1934.	
Alliance and Dublin	115–125	130–140	15
Barnet	150–155	165–170	15
Bournemouth sliding-scale	192–202	197–207	5
Brighton 5%	141–146	149–154	8
Bristol	111–112	115–116	4
British	145–150	155–160	10
Cardiff	108–113	126–131	18
Commercial	112–117	120–125	8
Croydon sliding-scale	145–150	152–157	7
Gas Light units	25/–26/–	25/6–26/6	6d.
Liverpool	124–126	129¾–131¾	5¾
Mid-Southern "C"	98–103	113–118	15
Newcastle units	24/3–24 9	25/9–26/3	1s. 6d.
Portsmouth 4%	160–165	168–173	8
Sheffield	117–118	135–137	18½
South Metropolitan	127–130	130–133	3
South Suburban	123–128	129–134	6
Tottenham	142–147	148–153	6
Uxbridge	135–140	147–152	12
Wandsworth	142–147	155–160	13

Current Sales of Gas Products.

The London Market for Tar Products.

LONDON, *April* 3.

There are a few changes to report in the prices of tar products, which are as follows:

Pitch, 57s. 6d. per ton f.o.b.

Creosote, 3d. to 3¼d. per gallon.

Refined tar, 4d. to 4¼d. per gallon in bulk at makers' works.

Pure toluole, 2s. 7d. to 2s. 8d.; pure benzole, 1s. 9d. to 1s. 10d.; 93/160 solvent naphtha, 1s. 8d. to 1s. 9d.; and 90/140 pyridine bases, about 6s.—all per gallon naked at makers' works.

Tar Products in the Provinces.

April 3.

The average prices of gas-works products during the week were: Gas-works tar, 23s. to 28s. Pitch—East Coast, 56s. 3d. to 58s. 9d. f.o.b. West Coast—Manchester, Liverpool, Clyde, 56s. 3d. to 58s. 9d.* Toluole, naked, North, 2s. 1d. to 2s. 3d. Coal-tar crude naphtha, in bulk, North, 6½d. to 6¾d. Solvent naphtha, naked, North, 1s. 5d. to 1s. 6d. Heavy naphtha, North, 10d. to 11d. Creosote, *ex* works, in bulk, North, liquid and salty, 2⅝d. to 2¾d.; low gravity, 2¼d. to 2⅜d.; Scotland, 2¼d. to 2⅜d. Heavy oils, in bulk, North, 3¾d. to 4¼d. Carbolic acid, 60's, 2s. 2d. to 2s. 3d. Naphthalene, £10 to £11. Salts, 55s. to 75s., bags included. Anthracene, "A" quality, 2¼d. to 3d. per minimum 40%, purely nominal; "B" quality, unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Tar Products in Scotland.

GLASGOW, *March* 31.

No material alteration has taken place in this market during the week. Prices remain fairly steady with a moderate volume of business being placed.

Crude gas-works tar.—The actual value is 35s. to 37s. per ton *ex* works.

Pitch.—Export value remains nominal at 50s. per ton f.o.b. Glasgow, while in the home market round 47s. 6d. per ton *ex* works in bulk is being quoted.

Refined tar.—Buyers are awaiting developments before committing themselves to any great extent, but quotations remain at 3d. to 3⅛d. per gallon f.o.r. naked.

Creosote oil.—To-day's prices are steady as follows: B.E.S.A. Specification is 4d. to 4¼d. per gallon; low gravity, 4d. to 4¼d. per gallon; and neutral oil, 4d. to 4¼d. per gallon—all in bulk *ex* works.

Cresylic acid.—This market is quietly steady. Pale, 97/99%, is 1s. 1d. to 1s. 2d. per gallon; dark, 97/99%, 11d. to 1s. per gallon; and pale, 99/100%, 1s. 4d. to 1s. 5d. per gallon—all f.o.r. in buyers' packages.

Crude naphtha.—Available supplies command 4¾d. to 5¼d. per gallon, according to quality and quantity.

Solvent naphtha.—90/160 grade is 1s. 5d. to 1s. 5½d. per gallon, while 90/190 grade is 9d. to 10d. per gallon.

Motor benzole.—Only small quantities are available at 1s. 6d. to 1s. 7d. per gallon.

Pyridines.—90/160 grade is 4s. 6d. to 4s. 9d. per gallon, and 90/140 grade is 5s. to 5s. 3d. per gallon.

Benzole Prices.

These are considered to be the market prices for benzole at the present time:

	s.	d		s.	d.	
Crude benzole	0	9	to	0	9¼	per gallon at works
Motor "	1	4	"	1	4½	" " "
90% "	1	4½	"	1	5	" " "
Pure "	1	7½	"	1	8	" " "

Contracts Advertised To-Day.

Gasholder Repair.

Burton-on-Trent Gas Department. [p. 46.]

New Capital Issues.

Weymouth Consumers' Gas Company.—As will be seen from our advertisement columns, Messrs. A. & W. Richards are offering for sale by tender, on behalf of this Company, £35,000 of 4% perpetual debenture stock at a minimum price of issue of par. Tenders must be received not later than 11 a.m. on Thursday, April 19.

Dudley, Brierley Hill, and District Gas Company.—The issue of £50,000 of 5% consolidated preference stock of the Dudley, Brierley Hill, and District Gas Company (the prospectus concerning which appeared recently in the "JOURNAL") was largely over-subscribed, the average price of the tenders accepted being £110 16s. 9d. per £100 of stock.

Plymouth and Stonehouse Company.—The recent issue of £120,000 4% perpetual debenture stock by this Company brought in applications amounting to £552,710, prices ranging from £100 to £114 per £100 stock. Applicants offering less than £103 received no allotment; tenders at £103 received approximately 90%, while those above that figure were allotted in full. The average price of the stock allotted was £103 14s. 1d.

Slough Gas and Coke Company.—The tenders sent in for the £20,000 4% perpetual debenture stock, offered by Messrs. A. & W. Richards, of 37, Walbrook, E.C. 4, on behalf of the Directors of this Company, were opened on March 27. They amounted to a total of £144,295 at prices ranging from £105 per £100 down to the minimum of par. The lowest accepted price was at £103 5s. per £100, and the average price obtained £103 8s.%. For the £80,000 ordinary stock, the tenders totalled £126,400 at prices ranging from £160 down to the minimum of £140 per £100, the lowest price to receive allotment being £143 0s. 9d., and the average price obtained £144 19s. 2d.%.

Trade Notes.

Willey & Co., Ltd.

The telephone number of Messrs. Willey & Co., Ltd., Manchester, has been changed to Ardwick 3909.

STOCK AND SHARE LIST.

Official Quotations on the London and Provincial Stock Exchanges.

Issue. £	Share.	When ex-Dividend.	Dividends. Prev. Hf.-Yr. % p.a.	Dividends. Last Hf.-Yr. % p.a.	NAME.	Quotations. Mar. 29.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices During the Week.
1,551,868	Stk.	Oct. 9	7	7	Alliance & Dublin Ord. ...	130–140	...	135–137
374,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb. ...	90–100	...	...
567,655	,,	Mar. 5	7	7	Barnet Ord. 7 p.c.	165–170	...	...
300,000	1	Oct. 28	1/9⅔	1/4⅔	Bombay, Ltd.	27/–29/-	...	...
178,480	Stk.	Feb. 19	9½	9½	Bournemouth sliding scale	197–207	...	...
559,050	,,	,,	7	7	Do. 7 p.c. max. ...	162–167	...	165
439,160	,,	,,	6	6	Do. 6 p.c. Pref. ...	142–147	...	...
50,000	,,	Dec. 18	3	3	Do. 3 p.c. Deb. ...	77–82	...	...
262,025	,,	,,	4	4	Do. 4 p.c. Deb. ...	101–106	...	...
335,000	,,	,,	5	5	Do. 5 p.c. Deb. ...	120–125	...	...
357,900	,,	Mar. 5	7½	7½	Brighton, &c., 6 p.c. Con. ...	161–166	...	...
540,000	,,	,,	6¾	6¾	Do. 5 p.c. Con. ...	149–154	...	151½–151¾
195,500	,,	,,	6	6	Do. 6 p.c. B. Pref.	135–140	...	...
1,487,500	,,	Mar. 5	5	5	Bristol 5 p.c. max.	115–116*a*	...	...
120,420	,,	Dec. 18	4	4	Do 1st 4 p.c. Deb. ...	101–103*a*	...	...
217,870	,,	,,	4	4	Do. 2nd 4 p.c. Deb. ...	101–103*a*	,,	...
328,790	,,	,,	5	5	Do. 5 p.c. Deb.	120–123*a*	...	...
855,000	,,	Sept. 25	8	7	British Ord.	155–160	...	...
100,000	,,	Dec. 18	7	7	Do. 7 p.c. Pref.	153–158	...	...
850,000	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	106–111	...	...
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb. ...	95–100	...	...
450,000	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	107–112	...	...
160,000	,,	Jan. 8	5	5	Cambridge 5 p.c. Deb. ...	115–120	...	...
100,000	10	May 22	6	4	Cape Town, Ltd.	4⅛–5⅛	–⅛	98/-
100,000	10	Nov. 6	4½	4½	Do. 4½ p.c. Pref. ...	6¾–7¾	...	...
150,000	Stk.	Dec. 18	4½	4½	Do. 4½ p.c. Deb. ...	95–100	...	99½
626,860	,,	Feb. 19	6	6	Cardiff Con. Ord.	126–131	...	129–130
237,860	,,	Jan. 8	5	5	Do. 5 p.c. Red. Deb.	103–108	...	...
157,150	,,	Feb. 19	5	6½	Chester 5 p.c. Ord.	112½–123½*b*	...	...
98,936	1	Oct. 9	2/-	2/-	Colombo, Ltd. Ord.	1⅝–1⅞	...	...
24,500	1	,,	1/4⅓	1/4⅓	Do. 7 p.c. Pref. ...	19/–21/-	...	...
609,204	1	Mar. 19	/11'48	/11'48	Colonial Gas Assn. Ltd. Ord.	1⅝–1⅞*	...	...
296,053	1	,,	1/8'80	1/8'80	Do. 8 p.c. Pref.	22/6–24/6*	...	...
1,775,005	Stk.	Feb. 19	5	6½	Commercial Ord.	120–125	...	120½
475,000	,,	Dec. 18	3	3	Do. 3 p.c. Deb. ..	77–82	+1	78½–80⅝
286,344	,,	Mar. 5	5	5	Do. 5 p.c. Deb. ...	119–124	...	...
807,560	,,	Feb. 19	7	7	Croydon sliding scale ...	152–157	+1	155–157
569,590	,,	,,	5	5	Do. max. div.	103–108	...	106½
620,385	,,	Jan. 8	5	5	Do. 5 p.c. Deb.... ...	120–125	...	120–125¾
542,270	,,	Mar. 5	7	10	Derby Con.	175–180*e*	...	...
55,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	98–100*e*	...	...
209,000	,,	Feb. 19	5	5	East Hull Ord. 5 p.c. ...	106–111	...	...
181,625	,,	Mar. 5	6	6	East Surrey Ord. 5 p.c. ...	126–131	...	...
175,609	,,	Dec. 18	5	5	Do. 5 p.c. Deb. ...	115–120	...	...
1,002,180	,,	Sept 25	†7	†5	European, Ltd.	125–135	...	124
19,342,763	,,	Feb. 19	5⅝	5⅝	Gas Light & Coke 4 p.c. Ord.	25/6–26/6*f*	...	25/9–26/1½
2,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	87–90	...	87½–88
4,477,106	,,	,,	4	4	Do. 4 p.c. Con. Pref. ...	103–106	...	104½–105½
6,102,497	,,	Dec. 18	3	3	Do. 3 p.c. Con. Deb. ...	84–87	+1	84½–84⅝
3,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. ...	116–119	...	117½–118½
3,500,000	,,	,,	4½	4½	Do. 4½ p.c. Red. Deb. ...	113–116	...	114½–115½
270,466	,,	Mar. 5	6	6	Harrogate New Cons. ...	125–130	...	...
82,500	,,	Mar. 5	7	7	Hastings & St. L. 5 p.c. Conv.	147–152	...	...
258,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	115–120	...	...
140,000	1	Oct. 9	†10	1/7½	Hongkong & China, Ltd. ...	29/– 32/-	...	...
218,200	Stk.	Mar. 5	6	6	Hornsey Con. 3½ p.c. ...	128–133	...	...
5,600,000	,,	Nov. 6	14	10	Imperial Continental Cap.	205–211	+1	206⅜–209
223,130	,,	Feb. 5	3½	3½	Do. 3½ p.c. Red. Deb.	89–94	...	...
235,242	,,	Mar. 5	8½	8½	Lea Bridge 5 p.c. Ord. ...	169–174	...	170½–173½
2,167,410	,,	Mar. 5	6	6	Liverpool 5 p.c. Ord. ...	129½–131⅜	...	...
245,500	,,	Dec. 18	5	5	Do 5 p.c. Red. Pref. ...	101–111*	...	...
306,083	,,	July 17	4	4	Do. 4 p.c. Deb. ...	101¼–103¼*	...	...
165,736	,,	Feb. 19	8	10	Maidstone 5 p.c. Cap. ...	180–190	...	...
56,176	,,	Jan. 8	3	3	Do. 3 p.c. Deb. ...	72–77	...	...
75,000	5	Dec. 4	†10	†10	Malta & Mediterranean ...	9 11	...	...
892,000	—	Oct. 2	5½	5½	Metropolitan (of Melbourne) 5½ p.c. Red. Deb.	98–103	...	...
231,978	Stk.	Feb. 19	5	5	M. S. Utility "C." Cons. ...	113–118	...	...
818,657	,,	,,	4	4	Do. 4 p.c. Cons. Pref.	95–100	...	99–99½
360,075	,,	Jan. 8	4	4	Do. 4 p.c. Deb. ...	100–105	...	...
148,955	,,	,,	5	†5	Do. 5 p.c. Deb. ...	117–122	...	...
675,000	,,	91 May '31	†6	6	Montevideo, Ltd.	60–70	...	61
2,061,315	,,	Mar. 5	5	5⅔	Newcastle & Gateshead Con.	25/9–26/3*d*	+/3	...
682,856	,,	,,	4	4	Do. 4 p.c. Pref. ...	99–101*d*	...	...
776,706	,,	Jan. 8	3½	3½	Do. 3½ p.c. Deb. ...	90½–91½*d*	...	...
277,285	,,	Nov 6	5	5	Do. 5 p.c. Deb. '48 ...	105–107*d*	...	...
274,000	,,	Feb. 19	5	5	Newport (Mon.) 5 p.c. max.	103–105*a*	...	...
204,940	,,	Mar. 19	7½	7½	North Middlesex 6 p.c. Con.	155–160*	...	...
396,160	,,	Feb. 5	5	5	Northampton 5 p.c. max. ...	99–104	...	...
300,000	,,	Dec. 4	7	†9	Oriental, Ltd.	147–152	...	...
316,617	,,	Dec. 18	8	8	Plym'th & Stonehouse 5 p.c.	165–170	...	...
504,416	,,	Feb. 19	8	8	Portsm'th Con. Stk. 4 p.c. Std	168–173	...	172
241,446	,,	,,	5	5	Do. 5 p.c. max. ...	105–110	...	...
114,000	,,	Feb. 19	5	5	Preston 5 p.c. Pref.	103–108	...	107–108
686,312	,,	Jan. 22	4	4	Primitiva 4 p.c. Rd. Db. 1911	87–92	...	...
389,813	,,	Dec. 18	4	4	Do. 4 p.c. Cons. Deb.	88–93	...	...
150,000	10	Mar. 19	6	6	San Paulo 6 p.c. Pref. ...	6⅝–7⅛*	+⅛	...
1,736,968	Stk.	Sept. 11	6	6	Sheffield Cons.	135–137*e*	...	...
95,000	,,	Jan. 8	4	4	Do. 4 p.c. Deb.	94–98*e*	...	...
133,201	,,	Feb. 19	8½	5	Shrewsbury 5 p.c. Ord. ...	135–140	...	...
90,000	10	June 12	15	14	South African	3–5	...	...
6,709,895	Stk.	Feb. 19	5	7	South Met. Ord.	130–133	–1	130–132
1,135,812	,,	,,	6	6	Do. 6 p.c. Irred. Pf.	138–143	...	140–141½
850,000	,,	,,	4	4	Do. 4 p.c. Irred. Pf.	102–106	+1	106
1,895,445	,,	Jan. 8	3	3	Do. 3 p.c. Deb. ...	84–87	+2	85½–86½
1 000,000	,,	Jan. 22	5	5	Do. 5 p.c. Red. Deb.	111–115	...	...
209,820	,,	Mar. 5	8½	8½	South Shields Con.	166–167*d*	...	...
1,543,795	,,	Feb. 19	6	6	South Suburban Ord. 5 p.c.	129–134	...	130–131
512,825	,,	,,	5	5	Do. 5 p.c. Pref.	114–119	...	116–119
300,000	,,	,,	—	4	Do. 4 p.c. Pref.	99–102	...	...
868,837	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	120–125	...	...
100,000	,,	,,	4	4	Do. 4 p.c. Deb.	100–103	...	...
647,740	,,	Mar. 5	5	5	Southampt'n Ord. 5 p.c. max.	109–114	...	...
121,278	,,	Dec. 18	4	4	Do. 4 p.c. Deb.	100–105	...	...
350,000	,,	Mar. 5	5½	5½	Swansea 5½ p.c. Red. Pref.	106–111	...	...
200,000	,,	Dec. 18	6½	6½	Do. 6½ p.c. Red. Deb.	103–108	...	...
1,076,490	,,	Mar. 5	6¾	6¾	Tottenham and District Ord.	148–153	...	151–152½
409,838	,,	,,	5½	5½	Do. 5½ p.c. Pref. ...	123–128	...	...
62,235	,,	,,	5	5	Do. 5 p.c. Pref. ...	110–115	...	...
199,008	,,	Dec. 18	4	4	Do. 4 p.c. Deb. ...	97–102	...	...
86,701	,,	Oct. 9	6	6	Tuscan, Ltd. 6 p c. Red. Db.	90–100	...	...
349,110	,,	Mar. 5	7	7	Uxbridge, &c., 5 p.c. ...	147–152	...	151
88,330	,,	,,	5	5	Do. 5 p.c. Pref. ...	110–115	...	...
1,322,220	,,	Mar. 5	7	7	Wandsworth Consolidated	155–160	...	155½–157
1,096,379	,,	,,	5	5	Do. 5 p.c. Pref.	117–122		120–121½
1,317,964	,,	Dec. 18	5	5	Do. 5 p.c. Deb.	120–125	...	...
158,400	,,	Mar. 5	5	6*g*	Winchester W. & G. 5 p.c. Con.	115–120	...	...

Quotations at:—*a.*—Bristol. *b.*—Liverpool. *c.*—Nottingham. *d.*—Newcastle. *e.*—Sheffield. *f.*—The quotation is per £1 of stock. *g.*—Paid £8, including 10s. on account of back dividends. * Ex. div. † Paid free of income-tax. ‡ For year. Hongkong & China, Ltd.—paid on £10 shares.

STOCK FOR SALE BY TENDER.

By Order of the Directors.
THE WEYMOUTH CONSUMERS' GAS COMPANY.

Messrs. A. & W. RICHARDS
are Instructed to OFFER FOR SALE BY TENDER
£35,000
FOUR PER CENT. PERPETUAL DEBENTURE STOCK.
Minimum Price of Issue, Par.

Prospectus and Form of Tender (which latter must be sent in by 11 o'clock on Thursday, 19th April) may be obtained of A. & W. RICHARDS, 37, WALBROOK, E.C. 4.

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Millions Sold Ask for Samples
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HELLIER STREET, DUDLEY, WORC.

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COPES REGULATORS LTD
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— FOR —
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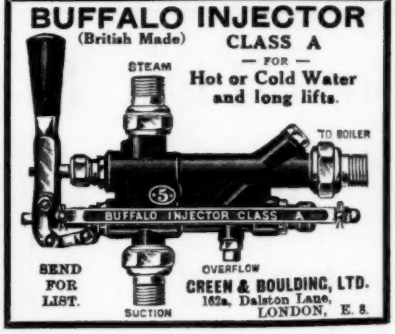

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